The Chemical Age

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Printed in Great Britain by THE PRESS AT COOMBELANDS LTD., Addlestone, and published by BENN BROTHERS, LTD., at Bouverie House, 154 Fleet Street, E.C.4.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1410. July 6, 1946 Annual Subscription 21s. Overseas 26s.

Money and Initiative

"MONEY," said G. B. Shaw, "is indeed the most important thing in the world, and all sound and successful personal and national morality should have this fact for its basis. Every teacher or twaddler who denies it, or suppresses it, is an enemy of life. Money controls morality." Into what form of national morality are we now running? It seems that within the lifetime of many of us the monetary situation has changed so radically that, like the Gadarene swine, it is running downhill into some sea in which we shall presently all be immersed to our undoing.

It is elementary to say that this country cannot exist unless it exports. But it is worth saying this in greater detail. In the year 1700, when we had little industry, this country had a population of 5½ million people. It did not support that population in any great comfort, it is true, and no less than a million were in receipt of poor relief. No doubt we could do better to-day with the increase in agricultural skill, with artificial fertilisers and machinery. But we doubt very much whether we could feed and maintain in reasonable comfort as many as 15 millions of people if we did not import from abroad. Before we can import, we must export. If anything occurs to prevent exports, we perish as a great nation, however rigid an austerity we may practise. All this, of course, is quite elementary, but because it is elementary it may be misunderstood. Not only is it elementary, it is fundamental to our whole political economy.

Why should we fear that anything can stop us from exporting? The answer is twofold. One part of the answer is the increasing industrialisation of all countries, which is already restricting our exports. No longer do these countries want from us our iron and steel, our textiles, or our other basic manufactures, unless we can supply them cheaper and of better quality than they can make them for themselves. In the words of Sir Clive Baillieu, no longer is it sufficient to live up to the motto "Britain delivers the goods": we must for the future *create the goods*. What will cause us to create goods? The answer surely lies in *incentive*. It is not enough to say that the incentive lies in the national need. The incentive to the necessary hard work and to the immense task and financial risk of development work must clearly be a personal incentive. That incentive is *gain*. Many chemists who have altruistic views, particu-

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larly young scientists who have not yet grown up mentally, will dispute that, maintaining that the urge to do good work is sufficient. For them there lies ahead only disillusionment. They are, in Bernard Shaw's words, enemies to life. As an American, Professor Lutz, has recently written (*Guide-posts to a Free Economy*, McGraw-Hill) that the essence of a successful national economy is this: "If you want to make a dollar by any honest means, you are free to try, and if you succeed, you may keep it." Is our monetary policy with its repressive taxation, its fleecing of the rich and the middle classes, its enormous public expenditure, its terrific national debt, creating the ground on which enterprise will be built up? It is not. The British policy appears to be: "If you want to make a quid by any honest means, you are free to try, and if you succeed, you must give it to the State." Even in Russia a system of high rewards for enterprise and good work has been found to be necessary.

The second part of the answer lies in the cost of production. If our cost of production becomes too high, the foreigner will buy from cheaper-production countries. The experience that the white races had with the Japanese before the war was in line with this. We complained about their cheap production by which, through their low standard of living, they undersold us. No doubt that was very reprehensible, and we shall take steps to see that they do not do it again. But if our costs rise too high other nations will certainly do it, and our last state will be as bad as our first. In the days when this country was really prosperous, income tax was so low as to be negligible and the national debt was trifling by modern standards. We should be the last to suggest that England was a perfect country in those days. There was too much extreme wealth and too much extreme poverty. It is no solution of that difficulty to lop off the top stratum of wealth and add it to the bottom stratum of poverty because the poor outnumber the rich by many millions. What must be done is to raise the standard of living of the lowest stratum. This we have done quite successfully, but for one reason or another income tax now takes away so high a proportion of the income of those who are the brains of the community that the incentive to enterprise has virtually vanished.

In the meantime, the tendency is for each class of worker in each successive industry to ask for increases in wages to keep pace with the increasing burden of cost. What happens? If the coal miners have their wages doubled, as they have been during the war, the price of coal is doubled. This means that everyone who uses fuels for heating or cooking finds that his fuel bill is increased, his cost of living goes up. Through his Trade Union he applies for an increase in wages, and gets it. Immediately the price of living of the miners goes up and they also require an increase in wages to compensate. So in every industry wages are chasing the cost of living and with each increase in wages the only real effect is to raise the cost of living for everyone else, with only a temporary advantage to those who have received the increase. The basic danger from all this is that costs of production are increased and our goods are being made far more difficult to sell abroad. A time will undoubtedly come when our costs of production are so much raised that it will become impossible for us to sell abroad. As we are in no sense a self-supporting nation it is easy to see that the end can only be disaster.

The same thing is true of the national debt. Two successive wars and many social schemes have raised our national debt to astronomical figures. There are many who argue that this does not matter and it is only an internal affair. Nevertheless, interest has to be paid on this money. The tendency in recent years has been to reduce interest rates and to cause about half the money that is paid out in interest to be returned to the Exchequer in the form of taxation. In effect, therefore, we are now compelling those who have lent money to the Government to give what is almost an interest free loan. The result is that those who formerly were wont to be thrifty and to put money in Government stocks to gain for themselves sufficient income for their old age now find that they cannot secure sufficient income to make it worth while. Thrift is rapidly disappearing from the land as a result of our monetary policy.

The national debt is to be still further increased. It has been stated by a contemporary that the value that must be paid for the various industries that are to be nationalised is of the order of £2,500,000,000. The theorist will say that since these industries have paid dividends in the past they will continue to do so, and

that the State has really got a very good bargain at the expense of the present shareholders. We quite agree that the present shareholders are likely to receive less for their shares than they could obtain in the open market, but the past history of nationalisation in other countries suggests that there will be no dividends from nationalised industries in a very few years, and that again in effect the State will be paying out this vast sum of money, upon which it must guarantee interest, and upon which there will be no return. The taxpayer will again have to meet the bill. The cost of living will rise. Exports will be more difficult to sell.

These views will do doubt be roundly condemned by the modern as reactionary. They may be so by modern standards. We are not economists. We are just trying to bring a little horse-sense to the situation to see where we stand, and frankly, what we see we do not like. We seem to be heading for disaster as a nation, and as a result of our financial policy. This policy is not necessarily the fault of the present Government. Much of it has been forced upon us by the two wars of this century. But the present policy of reducing all the nation to a dead level of mediocrity does not seem to help in the least. Why, we ask ourselves, should all be reduced to the lowest level because nine-tenths of the population have not the ability to rise above that level? It may be good socialism, but it is bad economics. Only through enterprise can this nation survive. And as our American friend has put it, the way to enterprise is to leave men free to make an honest dollar and, if they succeed, to keep it.

NOTES AND COMMENTS

Scientific Information

ALTHOUGH we are ourselves, so to speak, one of the defendants, we are in full sympathy with scientists and industrialists in their complaint that the difficulty of finding out what is being done, all over the world, in their particular field of work, is tending to increase. We are therefore glad to know that the Empire Scientific Conference has given due thought to this problem; it is high time, as both the number of scientific journals and the volume of scientific research are increasing almost daily. The obvious solution, though it is by no means as easy as it sounds, is to improve the available services of abstracting and indexing. The question is how to secure these improvements; and it seems probable that the way recommended at the Conference is as good as any, *viz.*: the appointment of a committee, representing all the interests concerned, including industrial users, to be convened by the Royal Society. Such a committee would explore all possible methods, including the provision of access to the less well-known journals, and it is recognised that to provide an adequate service to this end would call for specific grants-in-aid. No final decision was arrived at on the respective merits of the very brief abstract and the more detailed summary, but it was emphasised that abstractors must keep the needs of the *user* foremost—a sound point. The provision of scientific information services was also considered—a specially topical subject to-day—likewise the possibility of arrangements for the distribution of reprints, perhaps by an approach to copyright-holders for permission to make wider use of microfilm reproductions. Altogether, this was a distinctly constructive session.

Post Office Salvage

SCRAP lead amounting to 23,000 tons was recovered by the Post Office in 1945; scrap copper from instruments and fittings came to 11,000 tons; and the recovery of bronze and copper wire to 5700 tons. This is not a bad example of thrifty economy on the part of a Government Department, and we wonder, in passing, how the record of other departments compares therewith. The Stores Department of the G.P.O. has a special organisation to deal with "recovered stores," and, in accordance with the best industrial practice, such stores are first examined to see whether parts of them are capable of repair and further use. Unusable material, and waste which is of marketable value, are separated into lots for bulk disposal, the metals, for instance, being made up into sale lots of as many as twenty varieties. Lead from mail-bag seals is melted into ingots, and the dross from the melting has itself a sale value. The Post Office has its own melting plants in London and Birmingham.

In the announcement in which these facts (among others) are contained, the Post Office disarms criticism by quoting the man in the street as likely to comment: "What I should expect, considering the size of the firm." We agree, yet nevertheless it is not unpleasing to know that there is one Government Department which has a trumpet really worth while blowing.

Fuel and the Future

THE Fuel Efficiency Committee of the Ministry of Fuel and Power, under the chairmanship of Dr. E. S. Grumell, has arranged a conference on "Fuel and the Future," to take place in London on October 8-10. During the intervening months a campaign to promote fuel efficiency and fuel economy is being undertaken by the Ministry through various agencies, and the conference, which will come at the end of this summer campaign, is intended to focus attention on development during the next five to seven years, and on the fuel savings that can be made, both inside and outside industry, with the aid of the new equipment now becoming more readily available. The objective of the campaign is twofold: to promote a higher standard of efficiency in the employment of all forms of fuel in every possible field and to secure the maximum economy in use in the national interest and in the interest of consumers. The Ministers of Fuel and Power and of Health will open the proceedings at the Central Hall, Westminster, on the Tuesday morning, and the conference will then distribute itself among eight sections, six of them representing industries with related fuel problems. Special sessions will be devoted to the sizing and grading of coal and to district heating, and at the closing session the sectional chairmen will outline the proceedings of their sections. Details will be issued in the interim by the Ministry of Fuel, and further particulars can be obtained from their Fuel Efficiency Directorate, or from any regional office of the Ministry. The Institute of Fuel's Melchett Lecture will be delivered on the evening of the first day, and their annual reception, dinner and dance is timed for the second evening (October 9).

A trade agreement has been signed between Austria and Hungary under which Hungary will supply fruits, wines, and hides in exchange for Austrian soda, other chemical products and manufactured articles.

Metal Prices Increased

Non-Ferrous Metals

IN order to bring the selling prices of copper, lead, and zinc in the U.K. more closely into line with current purchase costs, the Minister of Supply has made the Control of Non-Ferrous Metals (No. 24) Order (S.R. & O. 1946, No. 964), which increases the maximum selling prices.

From July 1 copper prices are raised by £12 per ton to £84 ((copper rods by £12 10s. a ton); lead by £10 per ton to £55; zinc by £10 per ton to £49 5s.; and zinc oxide by £8 10s. per ton to a middle-grade price of £53 5s.

Holders of valid licences to purchase copper, lead, or zinc metal granted on or before June 29, may, on application to the Directorate of Non-Ferrous Metals, at 20 Albert Street, Rugby, cover themselves by purchases, where they have not already done so against such licences, up to and including July 15, at the old maximum prices.

Iron and Steel

The Minister has also made the Control of Iron and Steel (No. 50) Order (S.R. & O. 1946, No. 963), which came into force on July 1. This Order amends the maximum prices for certain iron and steel products and frees wire mesh from control. The main changes are increases in the price of Staffordshire pig iron, galvanised sheets, galvanised and fine sizes of wire, cold-drawn steel tubes, wire netting, and steel castings. The maximum prices for finish machined forgings are withdrawn. Reductions in price of ferro-vanadium and high-speed steel are confirmed.

Non-Ferrous Metals

Latest Scrap Prices

THE Minister of Supply has issued a list of selling prices of non-ferrous scrap metals. The prices relate to Ministry of Supply depots and are subject to sufficient supplies being available. They apply until the end of October and the list is published without prejudice or commitment. Inquiries regarding the list should be addressed to: Directorate of N.F. Metals (Scrap Disposals Dept.), Berkeley Court, S.E. Wing, Glentworth Street, London, N.W.1.

The following is a summary of the prices per ton of the various classes of scrap listed: Copper—scrap, £75 10s. to £78; turnings, £68. Zinc—scrap, £40. Brass—ingots, £67 10s.; scrap, £59 to £66; turnings, £54 to £55; 70/30 metallics, £50; 60/40 rod swarf, £49; 60/40 broken down fuse scrap, £56 10s.; 90/100 gilding metal scrap, £71 to £73; 95/5 cap metal webbing, £74. Scrap bullet envelopes—cupro-nickel, £82; gilding metal, £61 10s.

Phosphating Metallic Surfaces

I. History and Pre-Treatment

by W. G. CASS

THE use of phosphating for the protection of iron is said to date back to the time of the Romans, mainly on the authority of Jakobi, who, in his interesting book on the Roman castle at Saalburg, near Homburg vor der Höhe, dated 1897, described the remains of iron utensils which had every appearance of having been coated with phosphate by some means or other. Dr. W. Overath, in *Korr. u. Metallschutz*, 1931, *10*, 58, has some historical notes on the subject, and came to the conclusion that the Roman utensils found at Saalburg had been specially treated to resist corrosion; and Neuberger, in his *Technique of Antiquity* (Leipzig, 1920) also refers to early work in this important field. It is, of course, clear that the ravages of corrosion must have made themselves evident to all workers in metal at an early date, and means to check it must have been earnestly and eagerly sought.

But from a technical rather than an antiquarian point of view interest in phosphating methods began about the middle of the nineteenth century. One of the principal investigators into the early history of the subject, the Italian writer Macchia, is often quoted in this connection, both from his numerous contributions to *Korr. u. Mel*, *e.g.*, *Geschichte der Phosphatrostschutzes*, *loc. cit.*, 1936, *12*, 197, and his book on *Protezione Fosfatica del Ferro*, etc., Turin, 1938, followed by a German edition in 1940. A brief but informative summary of early history is also given in the standard German work on the protection of metals from corrosion, namely, that of Bauer, Kröhnke and Masing, in three volumes, published by Verlag von S. Hirzel, of Leipzig. The third volume containing the section on phosphating, pp. 315-375, was lithoprinted by the American publishers of German text books during the war, Edwards, of Ann Arbor, in 1940.

Early Patents

The earliest patents were those of G. Ross in this country (B.P. 3119/1869), and those of A. P. and N. P. Brown in Germany (G.P. 6998/1879), but they were of little technical or practical significance. According to Lange, in *Chem.-Tech. Vorschriften*, A. de Bussy found in 1849 that iron heated to redness after treatment with coal dust and potassium phosphate could better resist atmospheric corrosion. In his patent of 1869, Ross claimed a method of rust proofing by immersing red-hot iron articles in a phosphoric acid solution to form an iron phosphate coating. This appears to be the first mention of a phosphating bath, and was said to be particularly applicable to corset steels. In the Browns' German patent ten years later, the method described was that of immersing heated iron articles in concentrated sodium-ammonium phosphate solutions.

The history of phosphating continues to progress in ten-year stages, for the next date is 1889 or thereabouts, when Erlenmeyer and Heinrich had an article in *Liebig's Annalen* describing some work on manganese, dihydrogen phosphate which was subsequently continued by Viardo in 1899 (*Comptes Rendus*, 1899, *129*, 412). This earlier work in France was discussed at some length by V. I. Vulphson in his paper read at the Second Conference on the Corrosion of Metals, Moscow, 1943, though he gives the wrong reference to Erlenmeyer (*see* Viardo, *loc. cit.*).

Decomposition by Water

Viardo, in his paper on "Decomposition of Mono Manganese Phosphate by Water at 0 and 100°," says that such decomposition of $MnH_4(PO_4)_2 + 2H_2O$ by either hot or cold water has been known since the work of Erlenmeyer, etc. In cold water there was precipitated a crystalline di-manganese phosphate, $Mn_2H_2(PO_4)_2.6H_2O$, and in hot water a mixture of di- and tri-manganese phosphate. The reaction was thus already known qualitatively, but the work was incomplete from a quantitative point of view since the earlier authors carried out only three determinations -quite insufficient to evaluate the reaction at 100°. Viardo accordingly carried out two series of several tests at 0° and at 100°. In the low-temperature experiments he found that decomposition was so much the greater in proportion to reduction of the water present; and with a sufficient excess of water the monobasic salt may be dissolved without appreciable decomposition. This occurs, for example, when the ratio of salt to water is 1 : 100. If R is the ratio of total acid to combined acid, it will show the extent of decomposition effected by the water. P is the number of grams of monobasic phosphate reacting per 100 g. of MnO_2 and P_2O_5. The weight in mg. respectively of these substances contained in 1 g. of liquid of D density is as shown in Table 1 overleaf.

Thus, up to 20 per cent. P (to water) results are analogous to those in the cold and to the results obtained by Joly with

phosphates of Ba and Ca. That is to say, decomposition increases in proportion as the salt concentration increases—up to 20 per cent. Beyond that point it takes an opposite course and decomposition becomes less and less as salt concentration increases.

Table I

P	R	MnO_2	P_2O_5	D
10	1.06	19.75	41.9	1.06
20	1.14	33.39	76.04	1.11
100	1.19	96.42	232.05	1.39
and at	100°			
0.5	1.24	0.926	2.29	1.005
5	1.75	5.43	19.06	1.025
10	1.85	9.87	36.55	1.04
20	1.88	18.00	67.8	1.08
100	1.65	70.53	282.59	1.32
200	1.55	106.04	330.12	1.50
400	1.52	133.77	405.95	—

Vulphson also quotes Deermont (Leningrad Conference on Metals, 1933, *18*, 90), who gives a general equation for the decomposition of the metal dihydrogen phosphate into a mixture of di- and triphosphate, together with free phosphoric acid, and states that concentration of phosphoric acid in the solution remains constant through decomposition of the monosalt. The di- and tri-compounds formed are partly deposited on the metal and enter into the composition of the coating and are partly thrown down as sludge. According to Liebreich (*Z. Ang. Chem.*, 1930, *43*, 35) the free phosphoric acid reacts with the iron surface in stages with successive formation of mono-, di- and tri-ferrous phosphate, and evolution of hydrogen at each stage. Vulphson is of opinion that the phosphating process is rather more complicated, as indicated both by the composition of the solution (iron, manganese and phosphoric acid) and of the coating in which the iron content is about half that of the manganese or much less. He proceeds to formulate an electrochemical theory of phosphating.

These comparatively early speculations on what actually happens in a manganese (or any other) phosphating bath are of considerable interest in the light of the many diverse views since expressed both in the general and in the patent literature; and it is quite possible that they may have some bearing on the patent clashes which appear inevitable in this important field of anticorrosion work before very long, when questions of infringement and validity come to be tested in the courts. For the number of patents is now excessive, some of them undoubtedly very attenuated in respect of real novelty, and it is difficult to see how they can be maintained. One sample of what appears to be a particularly thin patent in the phosphating field may at least be quoted here. It is a process for phosphating zinc or galvanised surfaces, and its sole claim to novelty seems to reside in the use of a solution containing a higher iron content than usual, namely, 0.3 per cent. instead of 0.1 per cent.

Coslett's Patents

Although it is quite possible that Coslett, of Birmingham, may have derived some ideas from the earlier patent of Ross, it cannot be doubted that he, together with R. G. Richards, of Coventry, were the real founders of the phosphating business on a commercial scale. The first patent, in the name of Thos. W. Coslett, was B.P. 8667/1906. In this is claimed the treatment of iron and steel, to prevent oxidation, with a dilute solution of ordinary phosphoric acid, with or without the addition of iron filings, ferrous phosphate, or other material adapted to control or regulate the chemical reactions, in specified proportions, heated to b.p. It should be pointed out that in all phosphating processes strict control of temperature is important, and as a rule should be maintained just below boiling point. In Coslett's first patent, however, he stipulated boiling point, and therefore it is not correct to say that his temperature was just below b.p., as has been done in some quarters, for the distinction is a most material one. In a later patent, B.P. 28,131/1909, he claimed treatment with phosphoric acid in the presence of zinc, zinc oxide, zinc phosphate, or other zinc compound, together with iron filings The concentrated solution could be applied direct, or preceded by immersion in dilute solution, accelerated by use of electric current. Reference should also be made to his earlier patent of the same year, B.P. 22,743, in which importance of control of the free acidity of the solution was emphasised. In a still later patent, B.P. 247,071, Coslett included boric acid or borax in his solution, together with the use of the electric current. It will thus be seen that Coslett was a real inventor and introduced some of the basic principles of the phosphating process as used to-day. Progress since has, of course, been considerable in the aggregate, but it has, in the main, taken place by almost infinitesimal stages, and its record is littered up with patents of lilliputian novelty, if any, and not infrequently of doubtful utility.

Reference to the earlier literature should not omit the patent of Bullock and Calcott, B.P. 16,300/1909, in which an acid iron phosphate solution is used, together with the electric current to accelerate coating formation. The current did not, however, increase the protective value of the coating.

The use of manganese phosphate instead of or together with zinc phosphate was an important forward step, and was due largely to R. G. Richards, of Coventry (B.P. 17,563/1911), who collaborated with M. A. Adams

in work on manganese phosphate solutions

Brunskill's early patents are also of interest. In B.P. 169,884 is disclosed what is probably the first attempt to apply phosphating to aluminium alloys. It included boiling in an alkaline solution (caustic soda), steaming, treatment with solution containing zinc and iron phosphates, and final washing to remove free phosphates. The solution was prepared by action of *o*-phosphoric acid on granulated zinc, and the paste thus formed is prepared for use by prolonged boiling with scrap iron or steel. In his later patent for iron and steel, B.P. 182,988, Brunskill claimed immersion in solution of zinc dihydrogen phosphate in contact with metallic zinc, so that formation of the green iron phosphate is reduced to a minimum. The time required is said to have been ½ hr. to 3 hrs., and the larger the percentage of metallic zinc and the lower that of iron phosphate the more rust-resistant is the coating. If Brunskill actually did get any results in half an hour then he had achieved remarkable progress in a very important direction—that of reducing the time required for phosphating. This shortening of time, or accelerating, has been one of the principal aims of many subsequent patents, so that to-day the process is often claimed to be merely a matter of seconds.

Preparing the Surface

Although phosphating alone increases resistance to rusting, it is usual to treat the phosphated surface with a supplementary coating of oil or grease, or more usually of lacquer, paint, or enamel; and one of the great merits of the phosphate coating is that it very considerably enhances the adhesion and durability of this subsequent finish. Phosphating may thus be regarded as a preliminary bonding or preparation of the metallic surface for further treatment; and in order that it may most effectively play this intermediate rôle the surface, prior to phosphating, must itself be thoroughly cleaned and suitably prepared. According to the care and skill with which this is done, so will be the quality of the phosphate coating both as to its own intrinsic rust-proofing efficiency and its power to enhance the adhesive, protective, and decorative quality of the finish. Thus, very much depends on the preliminary cleaning and other preparatory operations.

Degreasing, pickling, and the general cleaning of metal surfaces is a very large and important technical field in itself, and need not be dealt with in any detail here. In addition, however, to what is generally understood by cleaning, there have been in the later patents some interesting claims for other methods of preparing a metal surface for phosphating, *e.g.*, some form of bonding film which may be electrolytically applied. For example, iron on which a thin film of electrolytic iron has first been deposited, is said to be more effectively phosphated. In fact, so far from competing with electrolytic methods of surfacing, the phosphating process is now being used in conjunction therewith as a valued collaborator: phosphating being applied to an electrolytic surface, or conversely a phosphated surface being electrolytically finished.

"Bonding Film"

In B.P. 534,852, the Parker Rust-Proofing Co., of U.S.A., claim a so-called bonding film which is first formed to facilitate application of the main coating, which, in this case, may be done either by chromating or electrolytically, and before action of the bonding solution has proceeded very far or lasted very long—not more than 5 30 sec. Many variations and examples are given, using a wide range of chemicals; but, generally, the preliminary film may be produced by any known phosphating method, and must be so thin that the main coating solution penetrates and reacts with the metal. This sounds interesting theoretically, but, as in many other phosphating and allied patents there is little information available as to its practical utility. In this case the bonding film appears to be formed by mere drying on the surface rather than by the usual reaction with the metal: in the latter event it is difficult to see how the main coating could be applied by action *through* the bonding film.

In a further patent covering similar ground, B.P. 547,408, Parker claims a bonding film which may consist of electrolytic iron, zinc, or other metal or alloy, having a maximum thickness of 0.0001 in., followed by chromating with or without phosphate, and possibly preceded by oxidising in acid solution (phosphoric or sulphuric) with one or more oxidising agents, or by heating, or simply etching; then wetting before chromating. The intermediate treatment is said to provide a thin coating, which is more reactive with hexavalent chromate.

Although these two patents rather refer to chromating as the main coating process, they indicate that phosphating may be combined with other methods in various ways. Probably more relevant examples of a preliminary bonding film for phosphating are provided in the patents of the Westinghouse Electric Co., B.P. 560,847-8. These claim compositions for activating metal and alloy surfaces to facilitate protective coatings (phosphating) by treatment with an aqueous solution of disodium-*o*-phosphate plus small amounts of a titanium compound, the *p*H being 8-8.5. It is said that the activating treatment takes only 10-45 sec., and the phosphating 30 sec.; also that metals previously difficult to coat with phosphate now readily take it, *e.g.*, zinc. It seems there-

fore that the bonding film, *inter alia*, is a powerful accelerating agent. Phosphating is followed by the usual rinsing and sealing with chromic acid solution. In subsequent patents, B.P. 564,521-2, the same firm claims other than titanium compounds, such as those of arsenic, bismuth, antimony, molybdenum, lead, or tin, together with an oxidising agent.

The preliminary coating of iron parts with a thin film of electrolytic iron, mentioned above, is claimed in various Parker patents (Can.P. 314,035, G.P. 562,561—in the name of the Parker Dutch Co.—and Fr.P. 683,486). It is said that phosphating can be continued until all the electrolytic iron is converted into insoluble phosphate.

Preliminary Cleaning

The American Chemical Paint Co. has given special attention to preliminary cleaning and embodies much interesting material thereon in its various patents, *e.g.*, U.S.P. 1,940,913 and B.P. 552,954, 544,640, 550,751. Alkaline and solvent cleaning are described and compared, the importance of subsequent rinsing is emphasised, and the so-called wiping effect is discussed at some length. Careful rinsing, both after acid and alkaline cleaning, is, of course, a primary essential: even with the most careful rinsing after alkaline cleaning, unaccountable variations occur in the steel surface. More recently considerable attention has been paid to the use of emulsion-type cleaners; and the inclusion of some form of colloidal agent has long been known, *e.g.*, silicic acid in the form of sand (Parker, B.P. 350,559).

Attempts to combine cleaning with phosphating in one operation or unit, or to dispense with preliminary cleaning, have been fairly frequent. Thus Parker (through Met Fin. Research Corp.), in B.P. 390,834, using copper in one form or another; Rust-Proofing Co. of Canada, Ltd., B.P. 464,982, using a fused salt bath which may include phosphates; H. E. Somes, B.P. 470,386, claims cleaning plus coating in a rather elaborate set-up with induction heating, etc.; Rohm & Haas Co., 496,746, combine pickling and coating (phosphating) using complex organics; Am. Chem. Paint Co. 501,739, using baths of zinc oxide and manganous carbonate, with accelerator (nitrite) and spraying; and A.C.P. Co. 571,976, supplementing the usual cleaners—phosphoric acid solutions with one or more solvents, wetting and emulsifying agents, inhibitors, etc.—with added emulsifying agents, as preparatory to painting rather than phosphating.

In further reference to this last-named patent, the use of phosphoric acid for preliminary cleaning was often thought preferable to sulphuric or hydrochloric, but needed a very thorough water rinse afterwards—as, of course, is also the case with other acid or alkaline cleaning—to which a neutralising agent could be added. A special phosphoric acid cleaner, for example, was introduced at an early date by the Parker European associates (Metallges. A.G. of Frankfort) under the name of "Antox," with which it is sufficient merely to wipe the metal surface with a leather duster. It contains free phosphoric acid, and zinc and manganese phosphates, with a fat solvent and general cleaning agent. (*See* G.P. 659,124, 660,436.) *See* also Grasselli, B.P. 467,839. and U.S.P. 1,949,921; and A.C.P. Co., U.S.P. 1,947,122; and Reynaud, Fr.P. 796,096.

But despite all this work and innumerable patents on chemical cleaning, the older purely mechanical cleaning still holds the field in most cases and is gaining favour. Certainly it eliminates wholly or nearly so any risk of traces of acid or alkali being left on the surface, which may play havoc with the phosphating process. The methods used, shot- or sand-blasting, barrelling with shot, sand, or steel punchings, are well known and widely used, with or without the usual degreasing, etc. In one or two patents it may be of interest to note that the mechanical cleaning is not intended to remove all rust, but only the loose or voluminous variety, the more compact and tightly held being retained as advantageous for subsequent phosphating, *e.g.*, in B.P. 517,916, of C. L. Boyle.

Additional pre-cleaning patents are: A.C.P. Co. U.S.P. 2,164,042, Curtin-Howe Corp. U.S.P. 2,127,207, and Metallurgical Treatment Synd., Ltd., B.P. 438,816 (cathodic pretreatment with copper- or nickel-salt solution), also Domnitsch & Dubrowski, Russ.P. 39,508, and *Korr. u. Met.*, 1936, *12*, 223.

(*To be continued*)

LETTER TO THE EDITOR

German Technology

SIR,—With reference to recent questions and answers in the House of Commons on B.I.O.S. reports, we think it should be made known that trade associations receive these reports free of charge, whereas non-members have to pay for them. Up to date, we have expended over £30 on this account.

Is not this preference unfair in respect of reports obtained at public expense?

We have found there is a great reluctance to publish details of preferences given by Government departments to trade associations, of which the above is yet another example, and we should be obliged if your space will allow you to print this letter in your next issue.—Yours faithfully,

for Athole G. Allen (Stockton), Ltd.
ATHOLE G. ALLEN,
Governing Director.

Stockton-on-Tees, June 25.

Review of Chemical Finance—I

Trends of Earnings, Dividends and Share Values

by S. HOWARD WITHEY, F.Comm.A., etc.

DURING the past twelve months, some rapid progress has been made in turning over to peace-time production, and in the chemical industries the problem of reconversion is less acute than for some other industries. The demand for chemical products has been heavy, and the attention of many boards has been directed to expansion of exports.

I.C.I

The accounts of individual companies submitted during the first half of 1946 show that although in many instances gross earnings have declined, net profit balances have had an upward trend. In the case of IMPERIAL CHEMICAL INDUSTRIES, LTD., for instance, there was a drop of £3,018,981 in the consolidated profit, but the balance of net profit for 1945 registers an improvement of £469,458. The amount attributable to the parent company was returned at £7,409,593, which figure compares with £6,972,988 in 1944 and £6,685,345 in 1943, and the allocation to the company's central obsolescence and depreciation fund was increased from £1,000,000 to £1,500,000. The capital of I.C.I. is £74,479,552, comprising £24,077,691 in the form of 7 per cent. cumulative preference stock—the dividend on which takes £1,685,438 gross—and £50,401,861 in ordinary stock, the dividend on which is maintained at the rate of 8 per cent. gross. This leaves the forward balance £192,006 higher, as indicated below:

	£
Brought forward from 1944 ...	1,145,274
Net earnings (Parent)—1945 ...	7,409,593
Disposable balance	£8,554,867
7 per cent. dividend on £24,077,691 cumulative preference stock, gross	1,685,438
8 per cent. dividend on £50,401,861 ordinary stock, gross	4,032,149
Transferred to central obsolescence and depreciation reserves ...	1,500,000
Carried forward to 1946	1,337,280
	£8,554,867

The consolidated balance sheet shows fixed assets at £48,585,052, while the current assets amount to £64,937,221. The highest and lowest market prices of the £1 stock units over the past three years are given below:

7 per cent. cum. pref. £1 stock units:	1943	1944	1945
Highest	36s. 7d.	36s.	36s. 10d.
Lowest	33s. 4d.	33s. 3d.	34s. 4d.
Ordinary £1 stock units:			
Highest	39s. 10d.	41s.	42s.
Lowest	36s. 9d.	37s.	34s. 4d.

At the recent price of 39s., the preference yield 3.6 per cent., and at 45s. the ordinary £1 stock units give almost the same return.

Monsanto

The trading profit and other income of MONSANTO CHEMICALS, LTD., amounted to £491,026 in 1945, representing a decline of £127,691 in relation to the corresponding figure for the previous year, but as the provision for taxation was £137,383 lower, the balance of net profit shows an improvement of £4,119. No special allocation is made to the staff fund, which a year earlier received £24,109, and the distribution of an ordinary dividend is resumed at 16.66 per cent., tax free. This company specialises in the manufacture of chemical products mainly for the pharmaceutical trades, and is controlled by the Monsanto Chemical Co., of St. Louis, U.S.A. The capital is £700,000, and consists of £400,000 in the form of 5½ per cent. cumulative preference £1 shares, which are redeemable at the company's option at any time before 1970 at 21s. 6d., and £300,000 in ordinary 10s. shares.

	£
Brought forward from 1944 ...	307,733
Net earnings—1945	94,997
Disposable balance	£402,730
5½ per cent. dividend on £400,000 redeemable cumulative preference shares, less tax	11,000
16.66 per cent. dividend on £300,000 ordinary shares, tax free ...	50,000
Carried forward to 1946	341,730
	£402,730

After deducting depreciation and obsolescence, and adding the cost of capital work in progress, the fixed assets amount to £498,921, and the current assets total £1,490,101. Recently, the preference shares were quoted around 23s.

Savory and Moore

In the case of SAVORY & MOORE, LTD., manufacturing and retail chemists, there was an expansion of gross earnings and a decline in net profit during the 1944-45 accounting period, and no special transfer was made to reserve. The trading profit was shown at £94,828, as compared with £80,538 pre-

viously, but after providing the sum of £40,552 for taxation, as against only £17,398, the balance of net earnings for the year was £15,280, compared with £20,725, and once again the ordinary capital is without dividend. The company directly controls a number of concerns, including Knoll, Ltd., and Pharmaceutical Products, Ltd., and the capital consists of £386,500 in the form of 5½ per cent. first redeemable cumulative preference stock, £47,997 in 6 per cent. cumulative preference stock, £102,003 in 7½ per cent. cumulative preference stock and £150,000 in ordinary stock. Recently, the 5½ per cent. preference £1 units were quoted at 23s. 6d., at which price the return is 4.7 per cent., and at 23s. the 6 per cents. produce 5.2 per cent. The 7½ per cents. yield over 7 per cent. at the recent price of 21s. 3d. The consolidated statement of the company and its subsidiaries shows fixed assets at £568,815, while the current assets amount to £612,894.

A slightly increased turnover was reported by the directors of SOUTHALLS (BIRMINGHAM) LTD., manufacturers of surgical dressings, bandages and kindred products, etc. In 1945, higher costs and lower profit margins reduced the trading profit to £221,360, but the substantial portfolio of marketable securities brought in a larger income, and a total of £243,875 compares with a trading profit of £310,673 in 1944. Reduced provisions for E.P.T. and income tax resulted in only a slightly reduced net profit balance, and the rate of dividend on the ordinary capital has been raised from 25 per cent. to 27½ per cent. After depreciation and adjustments the fixed assets have a book value of £414,509, and including investments for £705,385 the current assets total £1,393,034. The reserve receives £48,087, leaving the forward balance slightly higher, thus:

	£
Brought forward from 1944 ...	42,396
Net earnings—1945	112,621
Disposable balance	£155,017
27½ per cent. dividend on £468,000 ordinary stock, less tax	64,350
Transferred to general reserve ...	48,087
Carried forward to 1946	42,580
	£155,017

The capital is wholly in 5s. units, which yield 2¾ per cent. at the recent price of 50s. In 1945, the units fluctuated between 40s. and 51s.

Spratt's Patent

Shortage of raw materials has restricted the activities of SPRATT'S PATENT, LTD., but higher dividends from subsidiaries brought the trading profit for 1945 up to £96,956, as compared with £76,220 for the preceding year. The book value of the company's fixed assets was reduced by £15,000, and the balance of net profit was £5,738 higher at £79,458, enabling the ordinary dividend to be raised from 12½ per cent. to 15 per cent. by the distribution of a victory bonus of 2½ per cent. This company of manufacturers of foods for dogs, game, poultry, etc., has a capital of £650,000, made up of £50,000 in the form of 5 per cent. "A" preference shares, £150,000 in 6 per cent. "B" preference shares and £450,000 in ordinary shares of £1, and the forward balance registers a small improvement:

	£
Brought forward from 1944 ...	42,658
Net earnings—1945	79,458
Disposable balance	£122,116
5 per cent. dividend on £50,000 "A" preference shares, gross ...	2,500
6 per cent. dividend on £150,000 "B" preference shares, gross ...	9,000
15 per cent. dividend on £450,000 ordinary shares, gross	67,500
Carried forward to 1946	43,116
	£122,116

There is a general reserve of £230,642 and a depreciation fund of £75,000, and including investments the current assets amount to £573,862. The highest and lowest market prices of the ordinary £1 shares over the past three years are as follows:

Ordinary £1 shares	1943	1944	1945
Highest	61s. 3d.	63s. 9d.	67s. 6d.
Lowest	48s. 6d.	56s. 9d.	57s. 9d.

At the recent price of 65s., the yield is 3.9 per cent. on the basis of the victory bonus being a non-recurring payment. The "A" preference shares at 24s., and the "B" preference shares at 28s. 6d., give a return of about 4.2 per cent.

Milton Antiseptic

An expansion of sales was reported by MILTON ANTISEPTIC, LTD., and its subsidiaries, and both gross and net earnings were higher. The trading profit of £91,193 for 1944-45 includes income from subsidiaries, and compares with £77,323 in the previous year, and although income tax and N.D.C. absorbed £6,170 more, the balance of net profit after debiting depreciation and other charges came out £9,537 higher at £38,960. This company has a capital of £149,998, which comprises £51,922 in the form of 10 per cent. cumulative preference £1 shares—recently quoted around 31s.—and £98,076 in ordinary shares of 10s. denomination which again require a dividend of 15 per cent. After providing £25,707 for development, the forward balance is £3,301 higher:

	£
Brought forward from 1943-44 ...	84,643
Net profit: year ended September 30, 1945	38,960
Disposable balance	£123,603
10 per cent. dividend on £51,922 cumulative preference £1 shares, less tax	2,596
15 per cent. dividend on £98,076 ordinary 10s. shares, less tax ...	7,356
Provided for development	25,707
Carried forward to 1945-46	87,944
	£123,603

The general reserve is £60,000, and the fixed assets are shown at £166,650, while the current assets amount to £241,508. At the recent price of 42s. 6d. xd., the ordinary 10s. shares yield 3½ per cent.

Joseph Nathan

Restrictive conditions have again prevented JOSEPH NATHAN & CO., LTD., from satisfying the demand for the company's products, with the result that export business has been handicapped. The gross income received from the subsidiaries during the 1944-45 financial period amounted to £159,680, which compares with £170,530 for the previous year, but rental and other income brought the total up to £171,188, as against £178,767. After charging expenses, fees, interest and taxation, the balance, of net profit was shown at £87,988, representing an increase of £10,425 owing mainly to smaller taxation and enabling the tax-free dividend of 10 per cent. on the ordinary capital to be repeated and the forward balance to be raised. The company has a capital of £779,635, composed of £500,000 in 7 per cent. cumulative preference stock, £200,000 in 8 per cent. cumulative preferred ordinary stock, and £79,635 in ordinary stock:

	£
Brought forward from 1943-44 ...	31,584
Net earnings: year ended September 30, 1945	87,988
Disposable balance	£119,572
7 per cent. dividend on £500,000 cumulative preference stock, gross	35,000
8 per cent. dividend on £200,000 cumulative preferred ordinary stock, gross	16,000
10 per cent. dividend on £79,635 ordinary stock, tax free	7,963
Carried forward to 1945-46	60,609
	£119,572

The interests in Nathan's Sales and the wholesale provision businesses were disposed of, and measures are being taken to concentrate resources within Glaxo Laboratories and its subsidiaries. The fixed assets are shown at £800,424, investments at £134,280, and the floating assets at £2,482,714, and at the recent price of 5⅞ the ordinary 10s. stock units reflect the company's peace-time possibilities and developments.

Although the working profit of the BRITISH COTTON & WOOL DYERS' ASSOCIATION, LTD., was nearly £50,000 higher during the twelve months ended March 31 last, the charge for repairs and renewals was considerably higher than in 1944-45, so that after debiting depreciation, debenture interest and fees, etc., the balance of net profit was £10,736 smaller at £50,355. The rate of dividend has consequently been reduced from 6¼ per cent. to 5 per cent. The company has a share capital of £774,165, all of which is in the form of ordinary stock, the 5s. units of which are recently quoted at 8s. 3d., at which price the yield is little more than 3 per cent. There is £620,000 of 4 per cent. first mortgage debenture stock outstanding, and the highest and lowest market prices of this stock and of the ordinary 5s. units over the past three years are given below:

4 per cent. First Mortgage Debenture stock	1943	1944	1945
Highest	93	96½	105
Lowest	87	92	97
Ordinary 5s. stock units			
Highest	7s. 3d.	7s. 9d.	8s.
Lowest	5s. 1½d.	5s. 9d.	6s.

Current assets of £960,211 provide a surplus of £805,952 over creditors and provisions.

Bradford Dyers

After deducting E.P.T., the profit realised by the BRADFORD DYERS' ASSOCIATION, LTD., in 1945, registered an improvement of £9,116 at £634,076, and after charging depreciation, debenture interest and income tax, the net profit figure was £8,514 better at £183,182. This enabled the ordinary dividend of 5 per cent. to be repeated, and another £50,000 to be transferred to the general reserve. The loan capital consists of £1,109,568 in 4 per cent. debenture stock, and the share capital of £4,808,031 is made up of £2,549,237 in the form of 5 per cent. cumulative preference and £2,258,794 in ordinary stock. Highest and lowest prices over the past three years are given below:

4 per cent. first mortgage debenture stock	1943	1944	1945
Highest	98	103	106¾
Lowest	92	96	101½
5 per cent. cum. pref. stock £1 units: units:			
Highest	19s. 9d.	21s. 4d.	23s. 7d.
Lowest	16s. 10d.	18s. 9d.	20s. 6d.
Ordinary stock £1 units:			
Highest	23s. 10d.	25s. 6d.	28s.
Lowest	14s. 3d.	20s.	22s. 6d.

Recently, the debenture stock was quoted

around 105½, the preference units at 24s. 3d., and the ordinary around 25s. 9d.

Borax Consolidated

The gross earnings of Borax Consolidated, Ltd., show little change, the trading and other profits for the 1944-45 financial year being returned at £670,394, which figure compares with £678,997 for the previous twelve months. Heavier charges were incurred, however, and after debiting depreciation and taxation the balance of net profit was £96,238, contrasting sharply with £149,213 in 1943-44. There are two issues of debtenture stock outstanding, viz.: £1,000,000 in the form of 4¼ per cent. first debenture stock which fluctuated between 106 and 109 during 1945 and was recently quoted at 108 to yield 4.2 per cent., and £1,500,000 in 4½ per cent. debenture stock which at the recent market price of 105 gives a return of more than 4¼ per cent. The share capital is £2,700,000, made up of £800,000 in 5½ per cent. cumulative preference stock, £600,000 in 6 per cent. cumulative preferred ordinary stock, and £1,300,000 in deferred ordinary stock, on which a dividend of 7½ per cent. has been maintained.

	£
Brought forward from 1943-44 ...	281,495
Net profit: year ended September 30, 1945	96,238
Disposable balance	£377,733
5½ per cent. dividend on £800,000 cumulative preference stock. less tax	22,000
6 per cent. dividend on £600,000 preferred ordinary stock, less tax	18,000
7½ per cent. dividend on £1,300,000 deferred ordinary stock, less tax	48,750
Carried forward to 1945-46 ...	288,983
	£377,733

Recently, the preference stock was quoted at 13¾ per £10 unit, the yield on this basis being 4 per cent., and at 6¼ the preferred £5 units produce 4.6 per cent. The deferred £1 units give a return of 3.3 per cent. at the recent price of 45s.

United Glass Bottle

The finances of United Glass Bottle Manufacturers, Ltd., have been strengthened by stability of dividends and by building up reserves, and the rate of dividend on the ordinary capital is now 13½ per cent. After providing for E.P.T., the trading profit for 1945 is shown at £373,875, and investment income brought the total up to £437,398 as compared with £415,963 previously. At £196,756 the balance of net profit registers an improvement of £10,610, and the dividend is covered with a margin which enables another £50,000 to be transferred to general reserve and £20,721 to be added to the forward balance. This company has a share capital of £2,318,377, comprising £1,201,355 in the form of 7½ per cent. cumulative preference stock and £1,117,022 in ordinary stock:

	£
Brought forward from 1944 ...	55,521
Net earnings: 1945	196,756
Disposable balance	£252,277
7½ per cent. dividend on £1,201,355 cumulative preference stock, less tax	45,051
13½ per cent. dividend on £1,117,022 ordinary stock, less tax ...	80,984
Transferred to general reserve ...	50,000
Carried forward to 1946	76,242
	£252,277

In 1945, the preference £1 units fluctuated between 36s. 3d. and 38s. 9d., and were recently quoted at the latter price to return 3.9 per cent. The ordinary £1 units yield 3.6 per cent. at 75s.

(To be continued.)

Chemical Engineers

Institution's Award of Bursaries

THE Institution of Chemical Engineers has decided to establish two bursaries, each of £100 per annum, for the purpose of assisting students to obtain a bachelor's degree in chemical engineering.

Candidates must have reached the Higher School Certificate or Intermediate B.Sc. or equivalent standard; they may have spent a period in industry or in H.M. Forces. The bursaries will be tenable for three years, subject to satisfactory progress reports at the end of each academic year. The candidate is not restricted to his place of study, provided that the course is a full-time one and leads to a degree of the standard approved by the Institution. The bursaries can only be granted to such applicants who are able to arrange for admission to a degree course.

Applicants should be British subjects by birth and will be required to produce a copy of their birth certificate before the bursary is granted. In the case of candidates having equal qualifications, preference will be given to those whose applications are supported by corporate members of the Institution. Candidates on the short list may be required to attend for interview. The application should give date and place of birth, names and nationality of parents, and details of the applicant's school career.

Applications should be addressed to the Joint Honorary Secretaries, The Institution of Chemical Engineers, 56 Victoria Street, London, S.W.1, before August 1, 1946.

Natural Products of the Empire—II

Possibilities in New Zealand and South Africa

(*Continued from* THE CHEMICAL AGE, *June* 29, 1946, *p.* 729)

THE prime need of New Zealand's economy, Dr. Melville explained, is a diversification of her industry so that a fall in the world price level for the products of her sheep and cattle populations, a condition which in the past has had disastrous effects on her prosperity, can to some extent be buffered by the existence of other industries. In the absence of a heavy industry of any description the outlook for any major diversification is not bright and an important part of Dr. Melville's paper was devoted to a consideration of those industries directly related to New Zealand's primary industry.

Certain chemical industries, *e.g.*, lactose, casein and rennet are well established, but there appear to be opportunities, some of them largely unexplored, for the more efficient utilisation of certain by-products. For example, a relatively large quantity of orotic acid has been produced on a pilot-plant scale, but no market has so far been found for it. On the other hand, a sound gelatin industry is operating, with few technical difficulties. The total value of established and potential industries of this type, however, is small in relation to that of the industry on which they are based.

With the one exception of the utilisation of forest products, the same is true of industries not directly related to primary industry. Fish-liver oils from the *Makaira* "swordfish" and seaweed products—agar from *Pterocladia*, and alginic acid from *Macrocystis*—for example, appear to have real potentialities, but their growth to a position where they can act as an economic stabiliser to New Zealand's primary industry is out of the question.

With timber the position could be materially different. As a result of a combination of favourable factors, tree growth in New Zealand is rapid and her exotic forests are on a large scale, with extensive post-war plantings probable. More efficient utilisation of the products of the timber and pulping industries is an urgent problem facing all timber-producing countries. Its solution would automatically go a long way towards the desired diversification of industry in New Zealand. The production of fibre from New Zealand flax, *Phormium tenax*, continues to have a chequered career, but with proper breeding and selection the industry could become a valuable asset.

Products of South Africa

In Dr. van Eck's survey of the raw materials available in the Union of South Africa, the point was made that the economic aspect cannot be disregarded; it would thus appear that the best basis for developing resources is to observe the rule that all productive efforts be directed in accordance with the country's comparative advantages. The application of this rule would also have the most beneficial effect on the development of neighbouring territories.

In discussing mineral resources, particular emphasis was laid on iron, manganese and chromium ores. With the developments that have already taken place in the iron and steel industry, the production of stainless steels on a large scale may become of great importance because of the Union's favourable position; but research is still necessary. There are also possibilities of foundry development in the ferrous and non-ferrous fields. The Union has a great comparative advantage in its large and cheap coal deposits which in future should play an important part as a raw material in the chemical industry. With modern technological advances the coalfields become potential oilfields and the raw material basis for numerous important chemical industries

Some specially selected exotic trees grow faster in South Africa than in most other countries of the world. This fact, linked with chemical industries based on the sugar industry, emphasises the possibilities of masonite, paper, cellulose, and cellulose derivatives, provided that adequate water supplies can be made available to industry. However, although the Union has some great natural advantages it is deficient in other directions, and it seems probable that greater all-round progress will be made if there is closer collaboration with other African territories in the interchange of materials.

CRYSTALLINE PENICILLIN

Commercial production of sodium penicillin in crystalline form has been announced by the Commercial Solvents Corp., New York. Special crystallisation in the final production stage of the penicillin salt has made possible the production of the crystalline product, which has high potency and is heat stable. Refrigeration during storage and shipping is thus eliminated. The potency of the crystalline drug is of the order of 1400 to 1500 units per mg. and it will be available in single vials of 100,000, 200,000 or 500,000 units. It is white in colour and under a microscope the crystals are visible. Because of the increased purity, dosages as high as 200,000 units have been possible, as against dosages of 50,000 to 60,000 units with the former amorphous preparation.

Scientific Equipment

Promotion of Exports

FIRMS well known in the chemical industry are among the founder companies of a new organisation known as Scientific Exports (Great Britain), Ltd.—otherwise SCIEX—which, as its name implies, has as its objective the provision of export facilities in order to secure the widest possible distribution of scientific equipment.

The founder companies and their principal products are :

Adam Hilger, Ltd. Spectroscopic and other optical instruments.

W. Watson & Sons, Ltd. Microscopes of all types.

Baird & Tatlock (London), Ltd. Scientific instruments and laboratory apparatus of all types.

Hopkin & Williams, Ltd. Fine chemicals and Analar reagents.

Allen & Hanbury, Ltd. Surgical instruments and sutures.

W. Edwards & Co. (London), Ltd. High vacuum equipment.

E. R. Watts & Son, Ltd. Surveying instruments.

Wide Range of Products

All are firms of considerable standing which have already had extensive export experience, and they have pooled their knowledge in this organisation, thereby being able to offer a wide range of scientific products. During the past few months visits have been made by members of the organisation to India, the Middle East, and Latin America. Only recently, a group of members returned from Scandinavia and several European countries. It is intended that members shall visit other markets, and the possibility of local manufacture in various countries is already under consideration.

Mr. Marquand, Secretary for Overseas Trade, speaking at an inaugural reception recently, said the particular method of export which the new organisation was inaugurating was a very interesting one which should commend itself to other industries and trades. SCIEX represented the efficient association together of a number of firms producing non-identical products which were non-competitive one with another, but which served the same kind of general purpose and which were complementary to one another in the common purpose of selling abroad. The Export Promotion Department of the Board of Trade would be willing to help SCIEX in any way it could, also any other such organisation.

Mr. J. E. C. Bailey, president of the Scientific Instrument Manufacturers' Association of Great Britain, Ltd., congratulated SCIEX on its formation. He said the scientific instruments of this country were second to none, not excluding German products. It was known, for example, that about 75 per cent. of the lenses used in the great film industry are made in this country. Before the war, the laboratory was a necessary evil. It was the exception rather than the rule. All research expenditure was taxed, but now the laboratory had become important and everybody must have one. There was a big demand for British instruments.

In a pamplet published by SCIEX, it is described as a co-operative selling organisation designed to develop the export sales of British firms producing a wide range of high quality scientific and surgical equipment. It offers an economic and efficient method of obtaining the widest possible overseas distribution. The expenses of foreign travel and development of fresh markets, which would normally have to be made by each individual company, are met by SCIEX, acting on behalf of its member firms. All information is pooled and the overseas contacts of all its member firms are at the disposal of SCIEX. Although a complete export sales service is offered to member firms, a cardinal feature of the organisation is that member firms retain their own goodwill and identity in overseas markets.

The offices of SCIEX are at Buckingham House, Buckingham Street, Adelphi, London, W.C.2.

CHROME ORE PRICES

The Minister of Supply announces the following selling prices per ton for chrome ore as from July 1: (all delivered consumers' works) :

Refractory Grade.—Rhodesian; £9 17s. 6d.; Transvaal, £8; Grecian : 1st grade, £10 5s., 2nd grade, £9 7s. 6d.; Sierra Leone, £9 15s.

Metallurgical Grade.—Rhodesian washed concentrates, metallurgical, and Baluchistan, £10.

Chemical Grade. — Rhodesian Dyke chemical and Baluchistan chemical £10; X.L. concentrates, £10 2s. 6d.

REFINED OIL PRICES

The Minister of Food announces that the only changes in the present prices of refined oils and imported edible animal fats allocated to primary wholesalers and large trade users during the eight-week period June 23 to August 17 are as follows (all prices are per ton, naked, ex-works) :

Coconut Oil.—Refined deodorised increased by £7 to £56; refined hardened deodorised increased by £7 to £60.

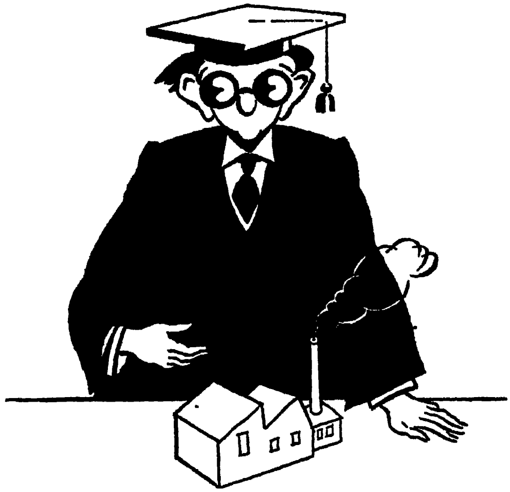
Palm Kernel Oil.—Refined deodorised increased by £7 to £56; refined hardened deodorised increased by £7 to £60.

Metallurgical Section

Published the first Saturday in the month

Our Master

of all Trades



The Ion Exchanger

further explains . . .

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Metallurgical Section

July 6, 1946

Reclamation of Wet Process Waste

The Use of Metallurgical By-Product Liquors

by A. G. AREND

WHILE most waste liquors and by-products from the majority of metallurgical processes have been turned to account recently in view of the desire to conserve raw materials, some of them are still disposed of without any attempt at reclamation. This does not relate to poor materials such as slags, cinders, or weak acid liquors from which all economically recoverable constituents have been extracted, but to those which, because of the complexity of their composition, have been ignored.

An example of this is seen in the by-product liquors which are discharged to waste in enormous volumes from wet extraction processes, of which copper systems are probably the most noteworthy. One of the unusual features of these is that there is sometimes more zinc present than the original copper content, *i.e.*, before extraction. The work of copper recovery is proceeded with, but the excess zinc is run to waste. This can be partly attributed to the fact that when these methods were originally instituted the market price of zinc was extremely low; and spelter from the distillation hearths sufficed for most purposes such as making cheap brass, galvanising, etc. To-day, pure electrolytic zinc is used for all higher-grade brasses and aluminium alloys, and appears to be in ever-increasing demand. Despite this, the fluctuating percentage of zinc in solutions of widely varying composition and concentration has done much to discourage the adoption of electrolytic processes on a large scale, a particular difficulty being the great surplus of iron salts.

Sodium Sulphate Recovery

Recognising these difficulties, research workers turned their attention to recovering sodium sulphate, and simultaneously converting the iron salts to a marketable condition. It should be understood that in the precipitation of copper, galvanised-iron scrap is more effective than ordinary sheet-iron scrap, which increases the zinc content of the solution. Where the original amount of iron has been rendered low by dint of suitable manipulation during roasting and leaching, it was proposed to substitute zinc for precipitating the copper. The enriched zinc liquors were then to be subjected to electrolysis, but in practice this method was not persevered with; many complications set in, excessive current was consumed, and the conditions had to be altered so frequently that the process was ultimately abandoned. Much more attention was paid to the sodium sulphate and iron salts, and either then, or earlier where permissible, the remaining zinc was recovered. In other words, the zinc was left to pay its own passage through the process, but if the zinc was present in insufficient quantity, this section of the work was omitted.

For each ton of ore originally treated for the extraction of copper, gold, and silver, as much as 150-200 gallons of liquor are produced. No trace of precious metals remains, but a small copper content is purposely left as it is uneconomical to iron this down beyond a certain limit (usually a 5 grains per gallon minimum).

Precipitation of Nickel

Most ores yield a liquor containing 4 grains of nickel per gallon, but richer varieties, which contained from 15 to 20 grains per gallon, used to be subjected to the cheap liming process. The resulting nickel mud, however, was not much in demand, as rich nickel ores abounded in great quantity elsewhere. An alternative system was a specialised zincing method which precipitated the nickel as a black, almost metallic mass, and yielded enriched zinc solutions, but the success of this was entirely contingent upon the subsequent economic electrolysis of zinc.

On the other hand, iron is present up to 5 or 6 oz. per gallon, and there is an even greater, although more fluctuating, quantity of sodium sulphate, and it was this disparity which at first attracted attention to recovering these as the main issue.

One of the practical difficulties which have always to be contended with in handling waste solutions is that there is often a large surplus of water, since no regard has been paid to this item. The bulk of the liquor tends to mount up after each filtration, and when precipitating copper, if

there is any evidence of diminishing action, fresh weak acid is added to assist the corrosion of the scrap iron, thus further diluting the material. When the reclamation pro-

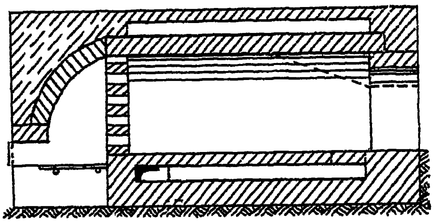


Fig. 1. Type of early brick-lined chamber in which waste liquors were evaporated to dryness.

cess is used, efforts are made to by-pass all wash liquors by removing them separately. Some indication of the sodium sulphate content will be gathered when it is mentioned that one works produced waste liquors containing as much as from 10 to 12 oz. per gallon, and each tank held approximately 2000 gallons. About 2 oz. per gallon of undecomposed sodium chloride, and an average of 4 oz. of iron (principally ferrous chloride) was also present.

Earlier Evaporation Methods

The evaporation of such a vast amount of liquor in order to crystallise out the salts not only involved the consumption of much fuel, but had to contend with a corrosive type of solution, sometimes containing up to 600 grains of free acid per gallon. This was a variable mixture of sulphuric and hydrochloric acids, the latter usually predominating. Triple-effect evaporators and other chemical engineering plant in the ordinary way were out of the question, and earlier work chiefly related to evaporating in extensive brick-lined chambers. During evaporation and final baking, the iron salts were all converted to the ferric state. The red mass so obtained was then digested in a minimum of water to wash out the crude sodium sulphate for final pan evaporation, and the fine ferric oxide was marketed as Venetian red. In one system, the final evaporation of the sodium salts, when worked at a concentration of from 1.37 to 1.40, was found to separate an almost pure sodium sulphate, completely free from iron salts, and containing only 0.25 per cent. of sodium chloride. Reference is made to a number of patented processes wherein lime was added, with or without the injection of air or steam to form oxidised iron pigments of different kinds.

Those who have seen these processes in actual practice will confirm that the almost phenomenal bulk of the precipitates which has to be handled in this way literally prohibits them from being carried out except in a modified manner, a state of affairs which can be partly attributed to the slow rate at which the ferric salts separate out from relatively strong liquors, and partly to the vast surplus of lime, or limestone, required. An attempted improvement on this was the substitution of calcium chloride liquors as the precipitant, but this merely added unduly to the cost. It was soon realised that because of the large surplus of iron tending to interfere with a good separation of the zinc, the presence of corrosive acid, and the liability of sodium sulphate to pollution, not to mention the vast excess of water, the problem of economical recovery was an extensive one.

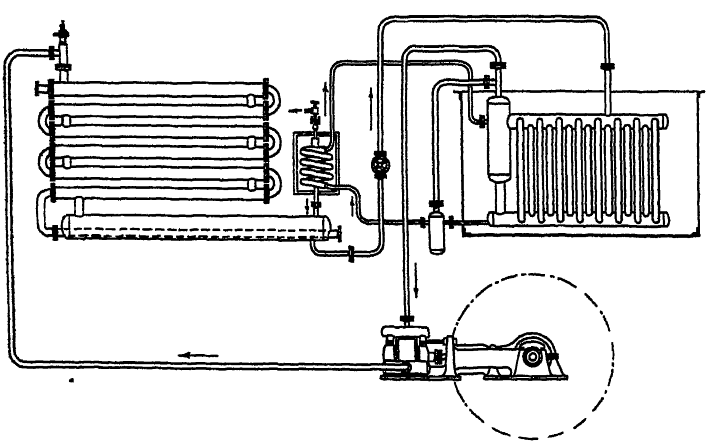


Fig. 2. General pipe-line arrangement of modern refrigerator layout. Note that the latent heat of congelation of water is only 45 B.Th.U./lb. as against a heat evaporation of 1000 B.Th.U./lb. when condensing by heating.

Of recent years, the developments made in refrigeration attracted attention, since intense cold can be applied in a relatively cheap manner when required for only a restricted period. Avoiding the large consumption of fuel required for evaporation, the application of refrigeration tackles the

problem from another angle. This would soon become costly if required for extended periods, but as it so happens, sodium sulphate crystallises out at a temperature of approximately $-3°$ C. Even if the temperature is reduced to $-10°$ C. not only sodium chloride, but also the chlorides of iron and zinc remain in solution.

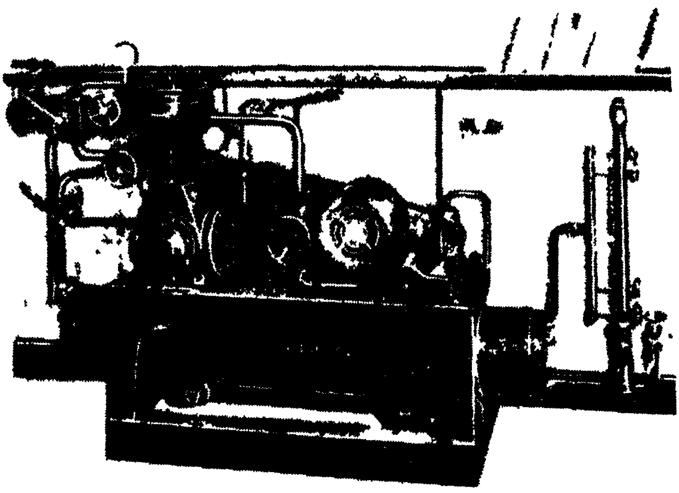


Fig. 3. A modern refrigerating machine, giving a good indication of its compact design.

When this process was first suggested, refrigerators were somewhat primitive in type, and the process was not given a fair chance of exploitation. To-day, however, with improved compressors, better pipeline systems, and mechanical handling methods, the crystallisation can be carried out economically and rapidly, so that sodium sulphate is recovered in pure condition, leaving the remaining liquor free from this its main constituent. A further convenience is that each batch of liquor, as it comes from the copper precipitation tanks, can be dealt with in rotation, thereby permitting continuous operation. The liquors are run into the refrigerator system after passing through settlers lined with glazed earthenware which reduce the warmth to almost normal temperatures, thus relieving the strain which otherwise would be put on the system. When the temperature is diminished beyond $-3°$ C. the crystals of sodium sulphate are seen to separate out rapidly, and are recovered as Glauber salts. As the freezing has caused surplus water to be included in the crystals, the remaining liquor is first run off, when the temperature is then allowed to rise to melt them off This rich liquor requires only a brief evaporation for crystallisation purposes when this section of the work is completed. Any adhering mother liquor on the crystals is washed off by water spray before the melting is done, to simplify the final crystallisation.

It is claimed that the Glauber salts thus obtained pay for the process by themselves, as the only capital outlay involves the cost of the refrigerator and its attendance, besides wooden crystal tanks. There is no point now in considering evaporation to acquire ferric oxide (as was originally intended) since the solution may contain nearly 90 per cent. of water. Most attention is therefore paid to recovering the zinc content at the expense of the larger quantity of iron.

Instead of using actual zinc for precipitating the copper in the regular process, as much galvanised iron as possible was used, and the liquors on occasion were known to contain upwards of 6 oz. of zinc per gallon. In presence of so much in the way of iron salts, the proposed electrolytic processes were found to be of little practical value. One method of treatment, dependent upon the zinc handled, is to utilise the zinc fume or flue dust made into a paste with water, and to add this to the liquors. This precipitates the iron comparatively easily, provided it has been well oxidised, and simultaneously enriches the zinc content of the solutions, which then can be easily electrolysed, or treated by other known methods.

A less well-known alternative process, hailing from a French source, consists in depositing the zinc, from accurately controlled acid solutions, as the sulphide. This, instead of giving the usual troubles of slow filtration, well known in laboratory practice, filters off relatively easily. The principle involved is that, provided the iron content is not in excess of a fixed figure, zinc alone is precipitated, and it is only when

the last of this zinc has been deposited, that iron starts to come down. The same remarks apply to any nickel which may be in the solution.

Great care is necessary in rearranging the acidity of the solution to a low pH value, moderate temperature, and constant agitation. Crude tank waste liquors suffice as the sodium sulphide reagent, but the addition should be made by gentle increments, when it will be seen that only a white or whitish precipitate forms. Too rapid addition causes the black iron or nickel to appear, and although constant agitation can relieve this, it is less troublesome to run in about ½ gallon per minute.

This separation can only be done in stages to ensure easy filtration through a filter-press, and a simple analytical test reveals when this has reached the point where the iron is about to come down. The zinc sulphide is dried, after filtering, and either roasted to make zinc sulphate, or disposed of as it is to paint manufacturers. In an instance such as the one mentioned, where the liquors contained as much as 6 oz. of zinc per gallon, some 750 lb. of zinc can be recovered from each 2000-gallon tank, and it pays to reclaim a third of this quantity. The remaining liquor can then be boiled to remove gas, and limed-down if there is any demand for an iron oxide pigment. In practice it transpired that, despite all the patents taken out to protect the various methods of precipitating limed-down iron oxide pigments, they were not much in demand, as paint makers were able to make these quite economically themselves.

Most attention has accordingly been paid to making certain of recovering the sodium sulphate and zinc, while incidentally leaving the liquors in good condition should any nickel or other metals appear in sufficient quantity to justify reclamation.

Metallurgical Problems

Research Work in the National Physical Laboratory

AS mentioned in THE CHEMICAL AGE last week (*see* p. 721) an opportunity was recently afforded the Press of visiting the National Physical Laboratory at Teddington and of inspecting some of the work that is in progress there.

Considerable interest was evinced in the Metallurgy Division, the primary work in which is research into the physical and mechanical properties of metals and alloys, their constitution and structure. It has many aspects, including the systematic examination of systems of alloys and the effect on their properties of various heating and mechanical treatments. Special attention has been given to the study of the age-hardening of light alloys. The methods of investigation involve the use of the microscope, X-ray analysis, electron diffraction and the electron microscope.

The study and development of aluminium and magnesium alloys have actively engaged the attention of the Division in connection with the use of these alloys in aircraft; and, on behalf of the steel industries, alloys of iron have been prepared in a state of exceptional purity, and their constitution and properties examined. Important investigations of the gaseous impurities of metals, of stress corrosion phenomena, and of the properties of steels and non-ferrous alloys at high temperatures have been made, and many very pure metals have been prepared, including iron, magnesium, beryllium, manganese and chromium.

In the physical section of the Division, the techniques of electron and X-ray diffraction are being fully utilised in studying metallurgical problems. Work is proceeding on the atomic structure of alloys, in particular iron-nickel-chromium; and an apparatus has been constructed for obtaining X-ray diffraction patterns from block specimens of metals at elevated temperatures up to 1000° C. In order to follow the rate of phase changes, electronic methods of recording the X-ray patterns instantaneously with the aid of Geiger counters are under development. Research is also in active progress on the changes in atomic and crystalline arrangement of metals under stress, and a new combined X-ray and tensile testing machine has been developed for special study of the atomic mechanism of deformation of metals at room temperature and also at elevated temperatures; it has been possible by the apparatus to obtain the stress-strain curve for the atomic lattice of metals and new data on the mechanism of deformation have already been obtained. In general, the work of this section may be summarised as an approach to metallurgical problems from the atomic standpoint.

Some of the unsolved problems in metallurgical science are being referred to electron microscopists in the hope that the high resolving powers available in their instruments, one of which is in use at the National Physical Laboratory, will reveal some significant clues which have remained hidden under the relatively low powers available in optical microscopes. The application of electron microscopes to metallurgy is, however, made rather troublesome by the neces-

sity for transforming the original specimen into a form suitable for examination in this new instrument.

The specimen is first highly polished so that its surface is flat. It is then etched in an appropriate reagent so that the various constituents are attacked differentially and are revealed as geometric features on the surface of the metal: thus a constituent which is relatively little attacked will stand proud of the general surface. A cast of the surface is then made; a typical method is to flood the surface with a solution of a plastic. On drying, the plastic forms a thin film, which is in intimate contact with the metal on one side and which has been pulled flat on the other side by surface tension. The thin film is detached from the surface of the metal and is examined in the electron microscope. A picture is obtained in terms of the varying thickness of the film; thus elevated areas on the specimen lead to relatively thin areas in the film and then to relatively bright areas in the picture. So, finally, constituents in the metal which are little attacked by the etching reagent are revealed as light areas in the pictures and heavily attacked constituents lead to dark areas.

In spite of the indirect method of examination, pictures have been obtained in the electron microscope at magnitudes of 10,000 diameters which are superior in definition to those obtained in optical microscopes at a magnification of 1,000 diameters.

High-Temperature Work

Progress in metallurgy involves a gradual increase in the temperatures of many industrial operations, and in this respect the needs of research are even more exacting. The production and utilisation of high temperatures are unfortunately subject to numerous limitations associated with the properties of refractory materials, and for many years it has been necessary for the laboratory to produce refractory ware specially adapted to the demands of research. The preparation and melting of pure metals are particularly dependent on the provision of suitable refractories. Thus, thoria crucibles have been used for determining the melting points of metals of the platinum group, beryllia crucibles are suitable containers for molten beryllium, and alumina crucibles for aluminium.

The pure oxides mentioned above have high melting points, and to make satisfactory ware from them it is necessary to use high-firing temperatures. For this purpose, various types of furnace have been developed in the laboratory, including a very efficient recuperative gas-fired kiln. The air supplied to this furnace by the suction of a chimney some 40 ft. high passes through a nest of refractory tubes heated from the outside by the exhaust gases from the down-draught oven. The oven is evenly heated by luminous flames, and the use of a chimney for the induction of air gives silent operation combined with reliability. The furnace has a long life at a working temperature of 1750° C. Higher temperatures are easily obtained either by reducing the life of the furnace, or by using superior, and therefore very expensive, refractories. It should, however, be remembered that at temperatures exceeding 1750° C. chemical reactions between different refractory materials occur readily, and difficulties are often encountered in supporting the objects to be fired. For this, and other reasons, it is desirable to reduce the firing temperature. Progress in the technique of producing bodies of pure oxides has already achieved results of this kind, and there is hope of further improvement.

Armour-Piercing Shot

During the war a considerable amount of research and development work on armour piercing shot was carried out in the Metallurgy Division. There was, at the beginning of the war, no general appreciation of the physical properties necessary in armour piercing shot, to ensure good performance when fired against armour plate. As a result of work carried out in the laboratory, in collaboration with various Service Departments, a considerable degree of success was achieved in the correlation of the physical properties (in particular the hardness distribution) with the penetrative performance of shot.

Experimental work on the effect of various heat-treatment factors, showed how the required hardness distribution could be obtained, so that the problem of producing shot was finally solved. Heat-treatments for most of the shot in production, from 0.5 in. to 3.7 in. calibre, were developed in the laboratory.

Considerable assistance was given to firms producing shot for the Services and special "calibration" shot used for the calibration of armour plate. The latter must be very uniform in quality and in this connection a non-destructive electrical resistance test has been found very useful.

The preparation of pure metals and a study of their properties are of fundamental importance, and work of this nature has been carried out for many years in the Metallurgy Division. The techniques developed during this work on the preparation of pure metals, and their alloys, of high melting points, are at present being utilised in a study of the ternary alloys of iron, nickel and chromium. These alloys form the basis of many oxidation and corrosion-resistant alloys, but there are ranges of composition and temperature over which excessive brittleness may occur due to the formation of a brittle constituent usually referred to as the sigma phase. A knowledge of the exact location of these ranges is of obvious importance, and their

determination in the pure ternary iron-nickel-chromium is at present being undertaken. The alloys are made by melting together the previously prepared pure metals —iron, nickel and chromium—*in vacuo* or in an atmosphere of hydrogen at reduced pressure. The crucibles used are of thoria-lined pure alumina, specially made in the Refractories Section of the Division. The ingots are then given a homogenising treatment by heating to 1325°C. *in vacuo* in a specially designed platinum-wound furnace, before being subjected to heat-treatments at various temperatures. The resulting structures are being studied by both microscopic and X-ray methods.

Studies on Hydrogen

It is generally accepted that hydrogen plays a very important part in causing cracks in arc-weld steel joints both in the weld metal deposit itself and also in the adjacent heat affected zone. In the enamelling of welded steel vessels also the presence of hydrogen is very deleterious as it tends to diffuse out during the enamelling process and leads to serious blistering of the glaze. An investigation has therefore been undertaken to determine the amount of hydrogen in weld metal and to ascertain its origin. Standard weld deposits were laid down under rigidly controlled conditions using a series of commercial arc-welding covered electrodes and the hydrogen contents of the various welds determined by the vacuum fusion method developed at the laboratory. At the same time the potential hydrogen present in various forms in the electrode coatings was determined and it was found that for the series of electrodes examined an approximately linear relationship exists between the total hydrogen in the weld deposit and the total potential hydrogen in the particular coating of the electrode with which it was made. It is, therefore, apparent that in order to eliminate hydrogen and its probable deleterious effects from weld metal, it is necessary to keep the potential hydrogen content of the electrode to a minimum.

During the course of the investigation it has been found that a considerable portion of the hydrogen present in weld metal diffuses out in the cold. The amounts were determined by allowing the diffusion to occur in a vacuum and collecting and analysing the evolved gas. The reason why only a portion and not the whole of the hydrogen diffuses in the cold is not yet understood, but it seems probable that the two forms of hydrogen play different parts in the different types of cracking that may occur.

A further point of interest is that the composition of the electrode coating plays an important part in determining not only the total oxygen in the deposit, but also in controlling the type of oxygen-bearing inclusions as shown by micro-chemical and X-ray analyses of residues separated from the metal by the alcoholic iodine method. The influence which these different types of inclusion may have on the properties of the metal are being investigated.

Iron and Steel

U.K. Output Figures Increasing

FIGURES showing the increase in output of pig-iron and steel ingots in the U.K. have been issued by the Ministry of Supply as follows (all figures represent tons):

PIG-IRON

	Weekly average	Annual rate
May, 1946	151,200	7,860,000
April, 1946	148,700	7,732,000
First quarter of 1946	145,500	7,566,000
First quarter of 1945	134,500	6,992,000
Whole of 1938	130,000	6,761,100

STEEL INGOTS AND CASTINGS

	Weekly average	Annual rate
May, 1946	261,900	13,619,000
April, 1946	252,100	13,111,000
First quarter of 1946	242,600	12,617,000
First quarter of 1945	233,200	12,126,000

AGE-HARDENED ALLOYS

Copper-manganese alloys containing 22-24 per cent. manganese, and an equal amount of nickel, respond well to age-hardening treatments and possess physical properties similar to those of the copper-beryllium alloys, according to a paper presented to the American Society of Metals by R. S. Dean, J. R. Long, T. R. Graham, and C. W. Matthews.

Quenching from 650° C. followed by aging at 350°-450° C. for periods up to 24 hours, depending on the hardness and other properties desired, has been found satisfactory. The hardness and physical properties obtained are reproducible within reasonable limits. Like copper-beryllium, these alloys age more rapidly from the cold-worked condition than from the solution treated condition.

Parliamentary Topics

Scientific Man-Power Scheme

IN the House of Commons last week, Mr. Erroll asked the Chancellor of the Exchequer whether, in view of the need to conserve scientific man-power, as indicated in the Report of the Committee on Scientific Man-power, he would arrange for an investigation to be made into the present use of scientific man-power in the Civil Service, with a view to ensuring that men and women with high qualifications were not wasted in low grades.

Mr. Dalton replied that efficiency in the use of scientific man-power was one of the main purposes of the new scheme, and he saw no reason for any special consideration.

Penicillin Production

In the course of a debate in which Mr. E. P. Smith moved the annulment of the Control of Penicillin (No. 1) Order, 1946 (*see* THE CHEMICAL AGE, June 1, p. 602), Mr. Leonard, Joint Parliamentary Secretary to the Ministry of Supply, gave some current production figures. Referring to the growth of average monthly production in the U.K. from 300 mega units in 1943 to 3200 in 1944, and 6000 in 1945, he announced that penicillin made available in June production this year would be about 300.000 mega units. From this total, some 56,000 mega units would be allocated to the Services. There would be export licences, leaving nearly 250,000 mega units for home and export use. "Export licences," he continued, "have already been granted for 130,000 mega units, leaving about 120,000 for home consumption, but it must be remembered that production is expected to increase fairly substantially over the next few months, and we are not now importing penicillin."

Cultivation of Oil Seeds

Mr. Hurd: Will the Minister of Agriculture make arrangements next season so that we can grow and obtain an increasing supply of our own oil seeds, because at present we have only a piecemeal policy?

Mr. Williams: I do not think the hon. gentleman can refer to it as a piecemeal policy, since for the year 1946 the price has been increased from £20 per ton delivered to £30 per ton at the farms. That is a matter of encouragement.

Linseed Oil Distribution

Dr. Edith Summerskill, replying to questions addressed to the Minister of Food by Mr. Touche and Mr. York, as to whether the Minister's attention had been called to the shipment of 7000 tons of linseed oil from the Argentine to the U.S.S.R., and whether he was aware that the purchase price was 60 per cent. above Combined Food Board agreed price, stated that Argentine linseed was allocated by the Combined Food Board and the United States had been negotiating with the Argentine authorities on behalf of countries to whom the linseed was allocated. So far as she was aware, the terms of the contract had not yet been settled. Approximately 7000 tons of linseed oil was being shipped from the Argentine in Russian-owned tankers. The Combined Food Board had consented to the transaction on the understanding that the oil was sold to UNRRA as a part of UNRRA's allocation and that it was distributed in territories for which UNRRA was responsible. She understood that the price for the oil had not been finally settled.

Palm Kernels and Ground-nuts

The Minister of Food, replying to a question by Major J. Morrison, stated that the imports of palm kernels and ground-nuts into the U.K. from West Africa since January 1 last were 121,220 tons and 144,500 tons respectively. He estimated the arrivals between the present time and the end of the year at 177,000 tons of palm kernels and 149,000 tons of ground-nuts.

Manufacture of Synthetic Oils

Mr. Boyd-Carpenter asked the Minister of Food whether he had made any recommendation to the Home Office with respect to the admission to this country of Dr. Theodor Ruemele, with a view to that gentleman's taking part in the manufacture of synthetic oils for soapmaking.

Dr. Summerskill: Representations to the Home Office have been made by my Department in this matter, and the hon. member will no doubt be hearing from the Home Secretary in the near future.

Lead Stocks

Mr. Marples asked the Minister of Supply whether he was aware that the stock of refined lead in the U.K. had dropped from 65,300 tons in December, 1945, to 44,600 tons in March, 1946, and what further steps he was taking to improve the position.

Mr. Wilmot replied that in the present acute world shortage of lead it was necessary to run down stocks. A comprehensive rationing scheme was in force and every effort was being made to obtain for this country its full share of the available supplies of lead. In the meantime, the maximum use must be made of substitute materials. Answering further questions, Mr. Wilmot said: "We are buying lead in association with the Americans, who are the other largest buyers, and we are satisfied

that by that co-operation we get the best supplies possible. To go into sheer competitive buying would not improve the position."

Visit of Russian Scientists

Major Vernon asked the Foreign Secretary whether arrangements were being made for inviting Soviet scientists to visit Britain in return for the visit which British scientists paid to Russia last year.

Mr. McNeil replied in the affirmative, stating that the Soviet Academy of Sciences had accepted the invitation of the Royal Society to send a delegation to the Isaac Newton Tercentenary celebrations in London this month and that cordial invitations had been issued by the Physical Society to a Soviet scientist to deliver the Guthrie Lecture, also to the Soviet Academy of Sciences to nominate a delegation to attend a conference at Cambridge in July.

Personal Notes

MONSIEUR FREDERIC JOLIOT and MADAME IRENE JOLIOT-CURIE were among the recipients of the honorary degree of LL.D. at the graduation ceremony of the University of Edinburgh on June 28.

DR. J. V. N. DORR, president of the Dorr Company, is visiting Germany to investigate developments in hydro-metallurgy and expects to return *via* London about the middle of the month.

Among the distinguished scientists who received the honorary degree of D.Sc. in the University of Oxford, on the occasion of the visit of the Empire Scientific Conference to that city, were SIR S. S. BHATNAGAR, of India, and SIR DAVID RIVETT, of Australia, each of whom has played a leading part in the development of chemical science in the British Commonwealth.

MR. J. MCKILLOP, whose work as chairman of the North-Western Branch of the Institution of Chemical Engineers has had so much to do with the success of that comparatively youthful section, retired from the service of I.C.I. on June 30. He has been chief engineer, since 1928, and division director, since 1939, of I.C.I., Ltd. (Dyestuffs Division), Blackley, Manchester.

MR. H. COURTNEY BRYSON, managing director of Bryson Processes, Ltd., has been asked to prolong his contract with Fabrica Lusitana de Tintas e Vernizes, Lda., the biggest firm of paint and varnish manufacturers in Portugal, owing to his work in reorganising the factory. He will therefore not be back in England until early August, and he will be returning to Portugal within a few weeks.

MR. A. B. BLUNSDEN has been elected chairman of the North Lincolnshire Scientific and Technical Society. This society was formed as a result of the successful joint meeting held in Scunthorpe between the Institution of Chemical Engineers and the Royal Institute of Chemistry last year.

MR. C. A. BODMER, of High Speed Alloys, Ltd., Widnes, and the HON. N. A. COZENS-HARDY, of Pilkington Bros., Ltd., St. Helens, have been elected to a committee whose main function will be to advise Ministers and their departments upon industrial conditions within their region and upon steps which may be necessary to bring their resources in capacity or labour into fuller use.

DR. J. MOFAKHAM, Director of the Technical College, Teheran, has arrived on a visit to Britain under the auspices of the British Council to see universities and technical colleges. In the London area he is visiting the Imperial College of Science, the National Physical Laboratory, the Northampton Polytechnic, and the Northern Polytechnic, and he will also inspect colleges and plants in Cambridge, Birmingham, Coventry, Manchester, Sheffield, and Halifax, notably the plant of firms making glassware and laboratory equipment.

Obituary

DR. THOMAS HOWELL LABY, Sc.D., F.R.S., Professor of Natural Philosophy at Melbourne University, has died at Melbourne, after a long illness, at the age of 65. Educated at the Universities of Sydney and Cambridge (where he took his Sc.D. degree) he took up the post of demonstrator in chemistry at Sydney in 1901, and later occupied the Chair of Physics at University College, Wellington, New Zealand, in 1909-15. In addition to his work on designing the box respirator in the first World War, and notable research on X-rays and geophysics, he was known to chemists the world over as part author of Kaye and Laby's invaluable *Tables of Physical and Chemical Constants*. He was elected F.R.S. in 1931.

FERTILISERS DECONTROLLED

The rationing of phosphate fertilisers was abolished from July 1 under a new Order made by the Board of Trade. During July, compounds containing potash can be obtained without permit in England and Wales. No person may, however, acquire a greater quantity of potash than his 1945-1946 permit authorised. The Order, known as the Control of Fertilisers (No. 32) Order, 1946 (S. R. & O. 1946, No. 966) amends the Control of Fertilisers (No. 24) Order, 1942.

German Technical Reports

Particulars of Latest Publications

SOME of the latest technical reports from the Intelligence Committee in Germany are detailed below. Copies are obtainable from H.M. Stationery Office at the prices stated.

CIOS XXXI—20. *Refining of cobalt, nickel, zinc, and cadmium* (2s. 6d.)

CIOS XXXIII—29. *Ruhrgas A.G., Essen*: Sulphur recovery from spent purifier oxide (1s.).

BIOS 8. *Manufacture and application of specialised magnetic materials generally*, including notes on other alloys requiring similar manufacturing technique (8s. 6d.).

BIOS 220. *Joh. A. Benckiser, Ladenburg, near Heidelberg*: Production of citric acid (1s.).

BIOS 258. *I.G. Farben, Griesheim*: Carbon electrodes (1s.).

BIOS 353. *Preparation of 5-diethylaminopentanol-2 by the Reppe process* (6d.).

BIOS 356. *Characterisation of butadiene catalysts by X-ray and chemical analysis* (1s.).

BIOS 451. *Titangesellschaft, Leverkusen*: Titanium pigments (2s.).

BIOS 458. *The ceramic industry of Germany* (4s. 6d.).

BIOS 473. *The manufacture of heavy clay products in Germany* (6s. 6d.).

BIOS 489. *Chemische Fabrik Joh. A. Benckiser G.m.b.H., Ladenburg Works*: Manufacture of calcium citrate (2s.).

FIAT 448. *Production of vanillin from sulphite waste liquor* (1s. 6d.).

FIAT 450. *Wood and cellulose research* (4s. 6d.).

FIAT 485. *Ferro-alloy manufacture and use* (1s. 6d.).

FIAT 486. *Cellulose ethers, esters and mixed esters at Biebrich (Wiesbaden), Elberfeld and Dormagen* (2s.).

FIAT 490. *Use of other materials than wood or cotton as sources of cellulose* (2s. 6d.).

FIAT 497. *Welding* (14s.).

Digest of Statistics

Chemical and Allied Figures

REDUCED production and consumption of chemicals in the U.K. is recorded in the recently published June issue of the monthly *Digest of Statistics* (H.M.S.O., 2s. 6d. net). In most cases, the latest figures available are for April and those given below are in thousand tons.

Sulphuric acid production, which rose from 141.4 in February to 165.1 in March, fell to 160.3 in April, and production of superphosphate, which rose from 72.2 in February to 88.1 in March, fell to 84.5. On the other hand, compound fertiliser production again showed an increase: it rose from 112.3 in February to 138.3 in March, and to 146.0 in April.

Consumption of pyrites, which rose from 16.5 in February to 19.1 in March, fell in April to 18.0. Consumption of sulphur for the manufacture of sulphuric acid showed an increase—17.0 in April as against 16.8 in March. Spent oxide consumption went down slightly: in March it was 16.6 and in April 16.4. Sulphuric acid consumption, which in March was 169, dropped in April to 158. The consumption of phosphate rock for fertilisers showed a falling-off—62.3 in April as compared with 68.6 in March. Superphosphate consumption also went down: in March it was 128.1 and in April 116.8. As in March, there was a marked increase in the consumption of compound fertilisers, the April figure being 231.1 as compared with 217.0 the previous month.

Stocks of pyrites, which rose from 70 in February to 84 in March, fell slightly, to 82 in April, but stocks of sulphur for the manufacture of sulphuric acid jumped from 39.3 in March to 59.0 in April. Stocks of spent oxide also rose, from the March figure of 132.7 to 134.6 in April. The decline in stocks of ammonia (excluding ammonia produced in by-product factories and converted directly into ammonium sulphate), noted last month, was again in evidence; in March the figure was 4.49 and in April 3.24.

Iron ore production, which dropped from 256 in March to 244 in April, went up to 245 in May, and the production of pig-iron likewise increased—from 149 in April to 151 in May. Virgin aluminium production showed an increase, the April figure being 3.29, as compared with 2.59 in March.

The estimated number of people employed in the chemical, explosives, coke-oven and by-product works (figures in thousands) was again lower: in April it was 225.3 (of whom 80.7 were females), as compared with the March figure of 228.3 and the February figure of 233.4.

A process has been developed by which explosives can be converted into fertiliser, according to Brig.-Gen. W. Draper, Chief of Economic Affairs of the American occupation authorities in Germany. As a result, the disposal of captured German stocks of munitions of all kind in the North Sea will be stopped. He explained further that the British authorities had carried out similar experiments in Belgium, and it has been found possible to produce Paranitrate and other similar compounds from explosives. An additional advantage of the new methods is that thousands of tons of steel can be salvaged.

General News——————From Week to Week

The Chemical Research Exhibition organised in London by I.C.I. was visited by 14,736 people, and the Cancer Research Fund will, as a result, receive the sum of £741 8s.

Manchester College of Technology has received a gift of £60,000 from Courtaulds, Ltd., to re-equip it completely with up-to-date apparatus and machinery for teaching and research in rayon technology.

The Chemical Society's library will be closed for stocktaking from August 5 until August 17, inclusive, and will close at 5 p.m. each evening from July 16 to September 30.

The Minister of Food announces that there will be no change in the existing prices of unrefined oils and fats and technical animal fats allocated to primary wholesalers and large trade users during the five weeks ending August 3.

Employees of Newton Chambers & Co., Ltd., Thorncliffe, Sheffield, appeared on Tuesday night in an opening performance, at Sheffield City Hall, of a pageant of the firm's history, in celebration of the 150th anniversary of the founding of the firm by George Newton and Thomas Chambers.

The Ministry of Fuel and Power announces that the address of the Organising Committee of the National Coal Board is now Lansdowne House, Berkeley Square, London, W.1., tel. GROsvenor 4070. This will for a time be the address of the National Coal Board when it is constituted.

Increases in the maximum prices for acetates which have been in force since January, 1941, are made by the Control of Molasses and Industrial Alcohol (No. 20) Order. 1946 (S.R. & O. 1946, No. 955). The Order, which came into force on July 1, amends the Control of Molasses and Industrial Alcohol (No. 19) Order, 1945.

The official cost-of-living index figure at June 1 was 103 points above the level of July, 1914, as compared with 104 points a month earlier. The fall in the figure was due to reductions in the prices of various articles of domestic ironmongery and pottery following the recent remission of purchase tax on such goods.

An aerial survey of banks of seaweed off the Orkney islands has been carried out by Capt. E. E. Fresson, of Scottish Airways, Ltd., with Dr. Woodward, technical adviser to the Scottish Seaweed Research Association. Good banks of seaweed were observed off North Ronaldsay. Sanday, Stronsay, Westray and Rousay. The Association is paying the islanders £3 a ton of dried tangles, plus 5s. a ton for bundling.

Virgin copper consumption in the U.K. increased during May to 30,030 tons, as compared with 24,040 tons in April, according to the British Non-Ferrous Metals Federation. Consumption of copper and alloy scrap (copper content) was also higher at 13,590 tons, against 11,440 tons.

The Treasury has made an Order, which became effective on June 29, exempting from Key Industry Duty until August 19, guanidin carbonate, guanidin nitrate, guanidin sulphate, and guanidin sulphocyanide. Copies of the Order, which is entitled "The Safeguarding of Industries (Exemption) (No. 3) Order, 1946" (S.R. & O. 1946, No. 884), may be obtained from H.M. Stationery Office, price 1d.

Construction of the new science building for the Newcastle division of the University of Durham is to begin immediately, according to a statement by Lord Eustace Percy. The building was planned before the war, and although the money from private benefactions and public subscription is still in hand, the cost will greatly exceed the original estimate, and application will no doubt be made to the University Grants Committee for a capital grant-in-aid.

The Sir John Cass Technical Institute, one of the few centres of higher education in the "square mile" of the City of London, has just issued its prospectus for 1946-47. The Institute had a narrow escape from destruction by enemy action in 1940, and the damage then sustained still necessitates a curtailment of the courses. Nevertheless, the courses in the Departments of Chemistry and of Metallurgy are full and varied, and the successes gained in the Faculty of Science of the University of London, and in the Royal Institute of Chemistry, attest the excellence of the instruction.

Unless buyers take delivery of a substantial quantity of sulphate of ammonia during the July-December period it will be impossible to deliver their full requirements in time for spring application, says the Ministry of Agriculture. The Government is, therefore, repeating its offer of a distribution allowance of 15s. per ton in respect of a strictly limited tonnage of sulphate of ammonia ordered immediately for agricultural use. Orders for lots exceeding two cwt. received by post by producers between July 1 and the date of the withdrawal of the offer are eligible for the allowance.

Foreign News

Czechoslovak glass exports have revived considerably in recent months and there is hope that the 1937 level will be reached this year.

An asphalt emulsion plant has recently been put into operation near Seoul, Korea.

The two fertiliser plants in the U.S. zone of occupation in Korea, located at Inchon and Samchok, are not in operation because of the shortage of ammonia.

Newfoundland exported last year the following tonnages of metal concentrates to the United States: lead concentrates 44,134 tons, copper concentrates 24,753 tons, and zinc concentrates 40,252 tons.

The Lonza Elektrizitätswerke und Chemische Fabriken A.G., Basle, reports a net profit, for the year ending March 31, of Swiss francs 3,286,875 (3,542,582). An unchanged gross dividend of 6 per cent. has been declared.

Spain's lead output amounted to 26,000 tons in 1945, compared with 34,000 tons in 1944, and a pre-war output of 300,000 tons. The shortage of power forced a number of mines to be closed down during the war years.

Chinese tung oil will be available in considerable quantities in Shanghai ready for shipment abroad as soon as transport facilities are restored in certain parts of the interior, according to an official of the China Vegetable Oil Factory, which is operating a number of tung-oil refineries.

Austria's two largest steel plants are to go back into production—Alpine Montan in the British zone, and the Hermann Göring works near Linz, in the U.S. zone—it was announced by Reuter last week. Full agreement on production programme now awaits only the approval of the Allied Commission.

In Belgium, the distillation of crude oil and its derivatives, with the exception of paraffin, pharmaceutical petroleum jelly, and pharmaceutical white oil, has been freed from Government control. Petrol rationing for motor vehicles has been abolished as from July 1.

A Dutch-Belgian trade agreement, valid for twelve months as from June 1, provides that Holland will deliver electrical and wireless apparatus, bulbs, seeds, potatoes and livestock in return for Belgian textiles, glass, wooden goods, iron, steel, chemical products and fertilisers.

France's iron-ore production amounted to 1,280,400 tons in April, compared with 1,295,700 tons in March, and a monthly average, in 1938, of 2,755,200. Exports showed a gradual increase, with 445,100 tons being exported, mainly to Belgium and Luxembourg, against 428,200 tons in March and a monthly average of 1,158,300 tons in 1938. Bauxite production totalled 34,500 tons in April, a decline by 1500 tons compared with March, while the 1938 monthly average amounted to 56,850 tons. Bauxite exports amounted to a mere 2000 tons.

Italy's steel output averages now about 53,000 tons per month, of which 27,000 tons are Martin and 26,000 tons electro-steel. This figure represents about 25 per cent. of the present production capacity, the fuel shortage being responsible for the low output.

A proposal that Japan's maximum annual steel production should be limited to 3,500,000 metric tons of steel ingot and 2,000,000 metric tons of pig-iron, is contained in a policy statement issued unanimously by the Far Eastern Commission in Washington.

Aluminium works in Germany, owned by the Swiss Aluminium Industrie A.G., will probably be closed down in accordance with the industrial scheme of the Allied occupation authorities. The plants in question are the rolling mills situated in Singen am Hohentwiel, and the smelter in Rheinfelden, South Baden.

Optimism for the future prospects of the Chilean nitrate industry continues; two nitrate plants at Taltal are to resume production. France is reported to be interested in acquiring nitrate and a trade agreement is being discussed with that country, while shipments to Valencia are expected to begin soon.

Oil seeds and their by-products have been put under Government control in Argentina. Stocks of linseed, sunflower seed, ground nuts, turnip seed, and cotton seed must be sold to the Agricultural Production Regulating Board and the quantity to be exported, as well as home and export prices, will be fixed officially. The official estimate of the 1945-46 sunflower seed crop gave a total of 1,101,600 metric tons, compared with the first estimate of 979,000 tons.

Negotiations have been opened between a North African financial group and the Government of the Regency of Tunisia for the resumption of bromine production from the lake of Sebka-el-Malah, near the Tripoli frontier. During the first world war, most of the bromine used by the Allies in the production of poison gas came from this lake, while a plant at Ain-es-Serab also produced potassium salts from it. After the war production was suspended.

In Turkey, all privately-owned chromite mines were closed down last year when Allied purchases came to an end. The Government-owned Guleman mines produced about 70,000 tons of chromite in 1945. Total stocks in the country were reported by the U.S. Embassy at Ankara at about 300,000 tons, much of which, however, is concentrating ore, and the Turkish Government was said to be negotiating in the United States for a concentrator to be installed at the Guleman mine.

Forthcoming Events

July 8. British Association for the Advancement of Science (in collaboration with the Royal Society). Lecture Hall, Royal Institution, Albemarle Street, London, W.1, 2.30 p.m. Conference on "Dissemination of Scientific Information to the Public."

July 11 and 12. Society of Chemical Industry. Annual meeting, etc. (*See* THE CHEMICAL AGE, June 8, p. 642.)

July 16. British Standards Institution. Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1, 3.30 p.m. Annual general meeting.

July 20. British Association for the Advancement of Science. British Medical Association, Tavistock Square, London, W.C.1, 10.15 a.m., statutory meeting of council; 10.45 a.m., statutory meeting of general committee; 12.45 for 1 p.m. (at Claridge's Hotel, Brook Street, W.1), luncheon; 3.30 p.m., general meeting—Sir Richard Gregory, Bt., F.R.S.: "Civilisation and the Pursuit of Knowledge."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

CHEMICALS & ESSENTIAL OILS, LTD., London, W.C. (M., 6/7/46.) May 30, debenture, to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; general charge, *—. July 14, 1943.

Company News

Pyrene Co., Ltd., report that, for 1945, profit amounted to £244,323. Three interim dividends, already paid, totalled 24 per cent., the same as for the previous year. **Goodlass Wall and Lead Industries, Ltd.,** have issued their full report for 1945. It shows net profit of £232,068, as against £222,635, and the recommended dividend of 10 per cent. is 1 per cent. higher.

The report of **Cooper, McDougall & Robertson, Ltd.,** for 1945, shows that a drop from £281,489 to £225,149 in combined trading profits was due principally to provisions made for a reduction in the value of certain stocks consequent on the end of the war. Profits available for distribution, however, were about £33,000 larger owing mainly to the incidence of taxation. Ordinary dividend is raised from 5 to 8 per cent.

At the annual meeting of **Lever Brothers** and **Unilever N.V.** in Rotterdam, the chairman, Mr. Paul Rykens, stated that war losses had been kept within the limits of the company's capacity to sustain them, and profits had been made enabling them now to propose dividends. Apart from losses suffered as a result of businesses being idle, direct war damage was limited to factories in enemy and enemy-occupied countries. The policy of nationalisation now being pursued in some Central and Eastern European countries, particularly Czechoslovakia, extended also to the company's businesses there, but he was not in a position at the moment to indicate the effect that policy would have on the company's interests.

New Companies Registered

Claritas, Ltd. (413,445).—Private company. Capital, £5000 in 3000 founders' shares of 1s. and 4850 ordinary shares of £1. Manufacturers of and dealers in chemical and scientific instruments, etc. Directors: M. J. Drew; H. E. J. Drew; J. C. H. Horsfield; B. G. Wood; F. G. Drew. Registered office: King William Street House, Arthur Street, London, E.C.4.

Chemical and Allied Stocks and Shares

THE rally in stock markets made further progress, though business in most sections was on moderate lines. An upward trend in British Funds was attributed partly to the expected announcement of the withdrawal of the "tap" issue of Savings Bonds, while industrial shares have been responsive to the export trade news, and generally dividend announcements have created a favourable impression. In the nationalisation groups, iron, coal and steel shares recorded small gains, while home rails responded mildly to the companies' anti-nationalisation moves.

Chemical and kindred shares reflected the prevailing trend of markets, Imperial Chemical moving up to 43s. 3d., while B. Laporte at 100s. held their recent rise, and Borax Consolidated deferred were 49s. 4½d. ex rights to the new shares, which were 7s. 9d. premium. General Refractories, however, eased to 22s. 6d. United Molasses have risen to 56s. 6d., partly on the prospect of the derequisitioning of the company's tankers, while Distillers were good at 132s. 3d. on further consideration of the past

year's figures. Higher dividend hopes kept British Glues & Chemicals 4s. ordinary firm at close on 15s., while Erinoid 5s. ordinary moved up to 14s. 9d. British Industrial Plastics 2s. ordinary were 8s. 9d., and De La Rue were £12⅝, and there has been activity in O. & M. Kleemann 2s. shares, which, following the commencement of dealings, advanced to 33s. 1½d.

Elsewhere, Fisons were dealt in up to 63s., and Cooper McDougall & Robertson up to 42s. British Drug Houses have been less active around 69s. awaiting the new issue decision. Burt Boulton & Haywood marked 27s. 6d. and Cellon 5s. ordinary 29s. 6d. In other directions, Monsanto Chemicals 5½ per cent. preference have marked 24s. 6d., and there was activity up to 12s. 7½d. in Greeff Chemicals Holdings 5s. ordinary, following the statements at the meeting. British Tar Products 5s. shares have been favoured up to 13s. and British Lead Mills 2s. ordinary up to 12s. 6d. Blythe Colour 4s. ordinary transferred around 48s. 6d., and William Blythe 3s. shares were dealt in at 13s.

Shares of base metal mines rose on the higher metal prices, and, likewise similarly influenced, Amalgamated Metal firmed up to 19s. 10½d. Imperial Smelting were 18s. 6d. In other directions, British Aluminium have been steady at 43s. Satisfaction with the results helped British Plaster Board, which strengthened to 37s. 6d., and Associated Cement at 71s. 3d. regained part of an earlier small decline. Ruston & Hornsby have been firm at 63s. 9d. on the full results. Babcock & Wilcox strengthened to 66s. Among iron and steels, Barrow Hæmatite rose to 29s. 6d. and Stewarts & Lloyds improved further to 50s., while Dorman Long 24s., Hadfields 24s. 9d., Shipley 30s., and United Steel 22s. 9d. were slightly higher. Thomas & Baldwins also firmed up to 10s. 3d.

Courtaulds continued active around 57s. 6d., with British Celanese 36s. 6d., and textiles generally have been firm on export trade prospects. British Oxygen rose to 101s. 3d. Lever & Unilever moved higher at 56s. 6d. and Lever N.V. were 56s. 9d. on the annual report. Dunlop Rubber continued active around 73s. 3d. Turner & Newall were 92s. 6d. and British Match firm at 50s. Boots Drug were good at 61s. 3d. Beechams deferred moved up to 27s. 3d., Sangers were 34s., and Timothy Whites 46s. Triplex Glass were 45s. 6d., and a rise to 49s. 9d. in Wall Paper Manufacturers was attributed to the purchase tax reduction, which will benefit the company, and also to hopes that paper supplies will improve later in the year. Oil shares failed to hold best prices, but Shell were good on the full results, while Attock and Lobitos showed good gains. On the other hand, Mexican Eagle Oil declined on the official statement that a settlement with the Mexican authorities seems as remote as ever.

British Chemical Prices

Market Reports

A FIRM tone is in evidence throughout the London chemical market and a fair activity is maintained in most sections, although the supply position still remains difficult. Firm prices are ruling in the soda products section, with prussiate and chlorate of soda in good request. A steady demand is reported for Glauber salt and salt cake and inquiry for hyposulphite of soda is maintained on a moderate scale. Caustic soda and bicarbonate of soda are active. Scarcity of offers is the chief feature of the potash section. A steady demand for acid phosphate of potash is reported, and permanganate of potash is a good market. There is an active inquiry for formaldehyde, and among the heavy acids, oxalic and acetic acid are moving well. Salicylic acid is firm and in steady request. Interest in the coal-tar products market is at the moment chiefly concerned with deliveries against contracts already made, although a good demand is noticeable in the markets for creosote oil and crude tar. Pitch is in brisk demand and the pyridines are quiet. Elsewhere the market displays a steady tone.

Manchester.—To some extent pressure for deliveries of chemicals under contracts on the Manchester market during the past week has been affected by the annual industrial holidays at several centres, a factor which has also not been without its influence on fresh inquiry. This seasonal factor apart, however, fairly steady trading conditions have been reported in most sections so far as home business is concerned and additional inquiries on export account have been a feature. The substantial rise in non-ferrous metal prices which came into effect on Monday will, of course, have a sharp reaction on the prices of chemicals other than the rise of £8 10s. per ton in zinc oxide, though at the moment of writing it is not possible to say exactly what the extent of these advances will be.

Glasgow.—A moderate demand for general chemicals for the home trade has been reported during the past week; prices, generally speaking, have remained firm. There has been a good volume of inquiry for export, but a considerable quantity of arrears of orders remains to be overtaken.

Price Changes

Lead, White.—Dry English, in 8-cwt. casks, £83 per ton. Ground in oil, English, in 5-cwt. casks, £94 10s. per ton.

Pitch.—Manchester: 75s. to 77s. 6d. per ton, f.o.r.

Zinc Oxide.—Manchester (maximum prices per ton for 2-ton lots, d/d): white seal, £54 5s.; green seal, £53 5s.: red seal, £51 15s.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Alloys.—Mathieson Alkali Works. 15410.

Splitting fats.—Orbis A.-G. 15511.

Preservatives.—Institute of Paper Chemistry. 15658.

Chlorinated compounds.—Progil. 15848.

Alkyl and aryl compounds.—Pyridium Corporation. 15392-5.

Monochromators.—Research Corporation. 15676.

Aneurin derivative.—Roche Products, Ltd. 15917.

Leather colouring.—J. H. Sharphouse, and I.C.I., Ltd. 15999.

Catalytic conversions.—Shell Development Co. 15381.

Catalytic cracking.—Shell Development Co. 15383.

Gas measuring.—Sigma Instrument Co., Ltd., F. R. Boosey, and J. Lexham. 15348.

Gas control valves.—South Metropolitan Gas Co., D. Chandler, and C. J. Templeman. 15810.

Superphosphates.—Sturtevant Engineering Co., Ltd., H. Richardson & Co. (York), Ltd., J. T. Procter, and A. Ogilvie. 15346.

Fibrous glass.—A. P. Thurston. (Owens-Corning Fiberglass Corporation.) 15795.

Plastics.—H. N. Toomey. 15681.

Thermoplastic material.—G. C. Tyce, and I.C.I., Ltd. 15994.

Lubricating compositions.—C. C. Wakefield & Co., Ltd. (F. H. Ayden.) 16052.

Streptomycin.—Wellcome Foundation, Ltd., and T. J. Woodthorpe. 16081.

Gas producers.—F. J. West, E. West, and West's Improvement Co., Ltd. 15970.

Distilling plants.—T. O. Wilson. 15964.

Phenacylpyridines.—American Cyanamid Co. 17067

Cathode-ray tubes.—H. P. Barasch 17236-7.

Cathode-ray tubes.—F. J. G. van den Bosch. 16927,17010.

Elastomers.—British Thomson-Houston Co., Ltd. 17100.

Polysiloxane compounds.—British Thomson-Houston Co., Ltd. 16954-5.

Cathode-ray tubes.—E. W. Bull. 17143.

Resinous material.—Distillers Co., Ltd., and L. Dennis. 17281.

Polymerisation products.—Distillers Co., Ltd., C. A. Brighton, and J. J. P. Staudinger. 17065.

Oxygen-containing compounds.—E.I. Du Pont de Nemours & Co. 17069-70.

Amino nitriles.—E.I. Du Pont de Nemours & Co., W. F. Gresham, and C. E. Schweitzer. 17071.

Insecticides.—Electrolux, Ltd. 17062

Distillation process.—K. W. Gee, and I.C.I., Ltd. 17072.

Water-repellent compositions.—M. Hopley, J. R. F. Jackson, and I.C.I., Ltd. 17190.

Fluid-flow systems.—K.A.C., Ltd., and W. P. Henderson. 17129.

Porous vinyl compounds.—Latex Industries, Ltd., and L. Landau. 16984.

Guanidine derivatives.—Lederle Laboratories, Ltd. 17066.

Complete Specifications Open to Public Inspection

Production of starch by means of centrifugal separators.—Aktiebolaget Separator. Dec. 5, 1944. (Cognate applications 32609-10/45.) 32608/45.

Igniting a cathode spot in current converters having mercury cathodes and resistance ignition. Dec. 8, 1944. 33367/45.

Liquid atomiser.—Aktieselskabet Niro Atomizer. Aug. 17, 1942. 12334/46.

Cellulose esters.—American Viscose Corporation. Dec. 6, 1944. 24192/45.

Apparatus and process for pressing plastic sheeting.—Bakelite Corporation. Dec. 9, 1944. 31590/45.

Coiled electrodes.—British Thomson-Houston Co., Ltd. Dec. 4, 1944. 32579/45.

Polymers of vinyl compounds and their preparation.—British Thomson-Houston Co., Ltd. Dec. 11, 1944. 33153/45.

Copolymers of vinyl compounds.—British Thomson-Houston Co., Ltd. Dec. 11, 1944. 33154/45.

Water-repellent agents, and the treatment of cellulose materials therewith.—J. R. Geigy A.G. Dec. 5, 1944. 32703/45.

1-Substituted-2, 5-diketo-7-methyl pyrimido-pyrazoles as couplers for colour photography.—General Aniline & Film Corporation. Dec. 5, 1944. 29246/45.

Fluid treating apparatus.—Hilliard Corporation. Dec. 6, 1944. 31662/45.

Instruments for measuring and controlling the modified viscosity of liquids.—A. C. Hoffman. Dec. 9, 1944. 24970/45.

Complete Specifications Accepted

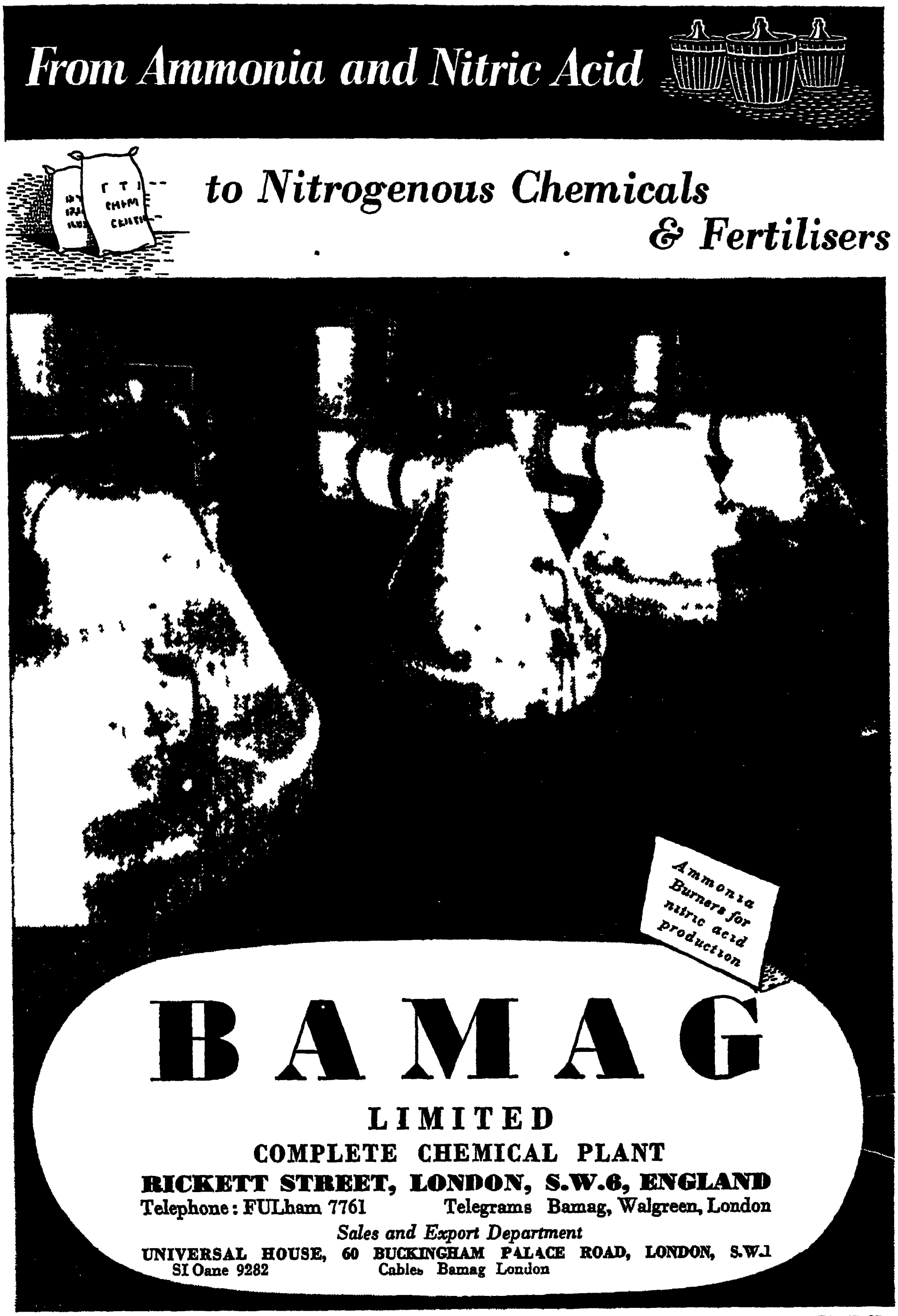
Polishes.—Koray, Ltd., C. D. Moore, and R. F. Ball. May 27, 1944. 577,515.

Process for the diffusion of metals into iron and steel.—R. L. Samuel, N. A. Lockington, and Metals Interchange Syndicate, Ltd. May 3, 1944. 577,504.

Process for forming plastic solutions and incorporating solid filling material therein. —C. E. Boutwell. April 14, 1944. 577,920.

Stabilisation of organic esters of cellulose. —British Celanese, Ltd. July 10, 1943. 577,963.

Containers for liquid fuels.—G. A. Griffiths, and I.C.I., Ltd. (Divided out of 577,951.) Feb. 6, 1942. 577,956.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Method of stabilising a plastic composition comprising ethyl cellulose.—Hercules Powder Co. April 27, 1942. 577,875.

Manufacture of chlorinated hydrocarbons. —W. N. Howell, and I.C.I., Ltd. March 15, 1943. 577,876.

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Manufacture of monobrominated dibasic acids and esters thereof.—Roche Products, Ltd., A. W. D'A. Avison, F. Bergel, A. Cohen, and J. W. Haworth. Aug. 21, 1944. 577,877.

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The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

BOUVERIE HOUSE, 154 FLEET STREET, LONDON, E.C.4

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1411. | July 13, 1946 | Annual Subscription 21s. Overseas 26s.

More About Carbon Black

THE importance of carbon black during the present century has been considerable and it may well have been its significance during the late unlamented war that has been responsible for two papers on the subject this year. One, the address to the S.C.I. by Mr. Alan Speedy, was the subject of our leading article on April 13. The other has lately been delivered by Major W. H. Cadman to the Royal Society of Arts. Major Cadman's paper adds considerably to our knowledge of the history and uses of this material and brings out the not unimportant fact that its major use, in connection with rubber, was a British discovery. The story goes that in 1914-18 a rubber compounder in Britain accidentally added 30 per cent. of carbon instead of 3 per cent. and as a result found he had made a superlatively good tyre. This story, however, appears to be more than a little apocryphal. It appears far more likely that the discovery was made at Silvertown about 1910 as the result of intentional research into the subject. A test-piece, containing 100 parts by weight of rubber, 10 of sulphur, and 30 of carbon black, was vulcanised by S. C. More on January 1, 1904, and led to a discovery which, according to Dr. H. J. Stern, "must rank among the greatest of modern times." Certainly it made possible the development of modern road transport, because without this addition rubber is unsuitable for tyres. The result has been that U.S. production of carbon black has leapt from 3000 tons in 1900 to 500,000 tons in 1945.

The carbon black position has changed materially with the coming of synthetic rubber. For compounding with natural rubber, channel blacks are effective and easy to use. They are difficult to use with synthetic rubber, whereas the soft furnace blacks are much easier. Consequently, the demand for furnace blacks increased rapidly during the war. Moreover, since 30 parts of furnace black are equivalent to 10 parts of channel black, the use of furnace black could be regarded as extending the availability of rubber.

A matter of considerable interest is the future of the carbon black manufacturing processes. Important though the product is, and high though its price may be, it is still an inefficient method of using natural gas. Even in the United States, home of prodigality in many things, natural gas is used primarily and most extensively for fuel purposes, both industrial and domestic. The history of carbon black manufacture has

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shown that this operation is discontinued and the plant removed elsewhere when fuel pipelines are laid to handle the gas; carbon production is always subsidiary to the use of natural gas as a fuel. It would seem that either the processes in use must be improved considerably in regard to their yield, or some process must be developed in which carbon black is a by-product. Production in Great Britain has not been very favourable in the past, since we have had no source of methane available that could be used for the purpose; and it is unlikely that any such source will ever be available here. Synthetic methane now under investigation by the Fuel Research Station and the Gas Research Board could not be sufficiently cheap for the purpose, and we are driven to use much heavier hydrocarbons. The difficulty is then immediately to produce a black having the necessary physical properties. There is use for quite a remarkable range of blacks, having diverse properties; but the several grades of black as produced by the various processes are not interchangeable. Consequently we may be reaching a difficult period when production from natural gas will be reduced—Major Cadman mentions that whereas there were 62 carbon black plants at work in 1928, there were only 49 in 1941, due to U.S. legislation—and there will be nothing to take its place.

There have been three attempts to make carbon black in this country. The first was in 1908, through the use of coke-oven gas, enriched with benzol and naphthalene, by an impingement process using rotating plates. This was started by Reckitts, of Hull. A larger plant was erected by the same firm at Thornhill coke ovens in 1911 to manufacture 500 tons a year. Here the plant was operated on coke-oven gas stripped of benzol, but enriched with naphthalene. The yield was about 1 lb./1000 cu. ft. of gas from the crude coke-oven gas, and about 5 lb. when the naphthalene enrichment was used. This process was of undoubted value, but it was closed down in 1933 because by then it had become uneconomic. Work has lately been conducted at the Chemical Research Laboratory, Teddington, and has (according to Major Cadman) been brought to a successful outcome. The report, which was privately circulated during the war, led to no industrial development, so far as we know. Preheated coal gas or other carrier, enriched with the vapours of liquefied tar, pitch, or petroleum residue, was passed through a heated burner-tube to six burners, where it burnt in a controlled supply of air. The flames from the burners impinged on a slowly revolving iron roller from which the black was removed by wire brushes. Yields of up to 50 per cent. of the weight of crude oil were claimed. Again, this process depends upon whether the value of the materials used is small enough, and it may not be an economic method. We do not think the economics of the method have been worked out, but from the information given by Major Cadman the material produced was highly satisfactory for its purpose.

We are driven to the conclusion that carbon black is best manufactured in this country by a process in which the black is a by-product. The only process of this character in existence, so far as we know, is that to which we referred in the previous article as the Severn Valley process, which Major Cadman mentions as "a British Process, invented by Leon B. Jones of the Jones Gas Process, Ltd." Mr Jones was an American resident in this country, but the process has been wholly developed here. In it carbon black is made by a thermal decomposition process in the presence of steam as a by-product of gas manufacture. There are two plants, one at Cheltenham, one at Gloucester, with a capacity of 2000 tons a year, and another at Swindon gasworks. No doubt, being a thermal black derived from aromatic materials, the product would have its own field of usefulness and might not be equally satisfactory for all the uses to which carbon black is put.

The rubber industry uses 90 per cent. of the total production, and printing ink about 5 per cent., while the other 5 per cent. goes to the paint, plastics, dry cell, and battery manufacturers, and to various other industries. "Assuming that the rubber used in 1948-9 is equally divided between synthetic and natural rubber, the carbon black required would be only about 1100 million lb. (based on an average of 21 lb. per 100 lb. of natural rubber, and 42 lb. per 100 lb. required by synthetic rubber)." The conclusion is reached that some of the less economical American plants will have to close down unless new uses on a sufficiently large scale are found for colloidal carbon. Major Cadman believes that ultimately, when natural gas is exhausted, carbon black will be made from acetylene produced by water power or atomic energy.

NOTES AND COMMENTS

Science News for the Public

AT the meeting held at the Royal Institution in London last Monday, organised by the British Association in connection with the Royal Society's Empire Scientific Conference, the question of the dissemination of scientific information was discussed by a number of speakers well qualified to give their opinion, the whole scheme having been prepared by no less an authority than Sir Richard Gregory, F.R.S. To provide a summation of the conference in all its details would require more space than we are able to afford, but there are certain points affecting the technical Press which are of great interest. The popular Press is advised, for example, to make greater use of the technical journals, as these deal usually with the application of scientific information and are as a rule not beyond the general reader. Scientific publications, on the other hand, as Sir Henry Dale has said, have developed a " slang " often unintelligible even to experts, and completely so to the layman. This is the " jargon " against which we have so often inveighed in these columns. The cautious summaries of public lectures are too often distorted by the Press simply to infuse a little life into them, and this process is regarded by the scientists as a betrayal, when, for example, a clause qualified by a " perhaps " is converted into an affirmation. Official or inspired announcements also require careful sifting before they can be regarded as of true news value.

An Institute of Information

SIR RICHARD GREGORY'S survey of the whole problem comes to the conclusion that some definite step is required to correlate all these sources of information. " The social hierarchy that has grown up among scientists," he states, " is responsible for a certain caution and conservatism about publicity," while at the same time " the media for disseminating news and information, whether scientific or not, have also become socially elaborate." Therefore there is scope for a new kind of popular expositor—one with a sufficient knowledge of the existing social organisation of science and with the ability to grasp enough of a particular specialism to be able to make a story of informative value to the public. To attain contact between the agencies responsible for the dissemination of scientific information and the original sources of scientific knowledge, something in the nature of an *Institute of Scientific Information* is needed. Its functions would be to keep records of scientific research; to be in touch with scientific workers in every field; to provide the Press with lists of points in pure science; to keep the Press and broadcasting authorities supplied with official scientific news; and to advise on all matters concerned with the publicity of science, even issuing pronouncements on highly controversial questions. There is at the moment in this country no learned body to which any pressman or other inquirer can go to discover either the location of scientists or the kinds of research in progress in any field.' It does not seem out of place to suggest that the British Association should be the parent and pilot of such an institution, in view of the type of work it has done in the past.

The Future of British Coal

HOWEVER gloomy may be the immediate prospects of coal production in the United Kingdom, it does not appear that we need have any serious fears that the supply will give out within the next hundred years. This is the main conclusion to be drawn from the new Fuel Research Survey Paper No. 58 issued by the D.S.I.R., and entitled *Rapid Survey of Coal Reserves and Production : a First Appraisal of Results* (H.M.S.O.; 9d.). The reserves dealt with, it should be noted, are not the *total* reserves, but those readily available within the next century. A new feature of the report is that it classifies the reserves for each coalfield into types of coal. The properties of 20,000 million tons of coal still in the ground are described and reference is made to a further 15,000 million tons that can be got at when eventually required. The general position, then, gives no cause for alarm; the nation has got its money's worth in buying the coal from the coal owners. One important point is the approaching depletion of reserves in certain areas, for example, West Durham and the Forest of Dean. Durham as a whole, however, is promised a long productive life, since " long after the medium-volatile coals (of West Durham) have been exhausted, the field will produce coals similar in type to the best

coals now used in coke ovens in the Midland areas." Moreover, not only in South Wales, but also in Lancashire, the Midlands, Northumberland, and Scotland, the great virtue of our coals lies in their adaptability to almost any purpose. Though the coals are here grouped according to volatile content and caking properties, it is emphasised that this is not an exhaustive classification of British coals; there are yet more data to be collected, and this work is already in hand.

Minerals in Istria

BECAUSE the future of the Julian March and the port of Trieste has, for over a year, occupied the attention of the Foreign Secretaries of the four major Allies, it is of interest to note that the president of the Italian Mining Federation has recently stated that only a trickle of news has been reaching Italy about mining operations in the mineral-bearing regions of the Istrian Peninsula and its neighbourhood. Thanks to the initiative of Italian companies, and the efforts of technicians and workers alike, the region has attained a high level of production, and consequently it assumed an important rôle in the national economy of the country. Annual pre-war production figures for the main minerals are as follows: coal 1,000,000 tons, bauxite 400,000 tons, mercury (from Idria) 480 tons, sandstone 70,000 tons, limestone 400,000 tons. In particular, the loss of the Arsa coal and anthracite deposits would have a severe impact on the Italian fuel supply position, because one-quarter of the country's normal consumption came from this source before the war. The bauxite mines in Istria were also of importance in the country's economy: they have been the basis for the aluminium industry which played an important part in overcoming many difficulties caused by the general paucity of raw materials and minerals.

Chemurgy Again

THE better utilisation of farm products and waste material by American chemical industry was the principal aim of the chemurgical movement which originated in that country in 1934 or thereabouts, at a time when agriculture was at its lowest ebb in many parts of the world. *Farm Chemurgic*, the book by Dr. W. J. Hale, of the Dow Chemical Co., published in 1934, seems to have inspired a considerable amount of active support to the movement which gathered increasing momentum before the war. The pursuit of chemurgy was more than ever a primary need under war conditions; and to-day, with half the world at starvation level, it merits the concentrated attention of both industrialists and agriculturists. For although the original intention was the better utilisation of farm products and waste as industrial raw material, it has become increasingly clear that the matter is of the utmost importance from the food point of view also. The Farm Chemurgical Council of the U.S.A. recently held its annual congress in St. Louis, when several interesting papers were read. A brief account of the proceedings was published in *Chem. and Eng. News*. But chemurgy and all that it stands for is of considerable importance also in this country, even more in the Dominions and Colonies. The second report of the Colonial Products Research Council describes research on many colonial products (much of which would doubtless have been done if chemurgy had never been heard of); but the essence of the chemurgical idea is to reduce waste to a minimum by application of more scientific and improved technological methods. In Canada the Prairie Regional Laboratory of the N.R.C. is being organised for chemurgical work, as a result of a conference held under the auspices of the Council a few weeks ago. It is mainly intended to serve the needs of the west, but these must be considered and co-ordinated with those of the eastern provinces, and joint action taken.

Export or Die!

HERE is a remarkable case, the accuracy of which is vouched for by the *Liverpool Daily Post*. A scientific man of the highest standing required 25,000 glass bottles. He went to the head of a manufacturing firm, but after several weeks learnt that by governmental orders all their output had to be exported. He received a hint that he might obtain a supply from Holland. Eventually he did get the required number from Antwerp, at an additional cost of 30 per cent. He then discovered that these had been made and compulsorily sent over the Channel by the English firm in question. Is this the way in which our export output is augmented—to be brought back at large additional expense to ourselves? Can it also be that the report of increased beer exports from Holland is similarly due to *our* increased exports of barley to that country?

Phosphating Metallic Surfaces

II. Baths and Compositions : Accelerating Methods

by W. G. CASS

(*Continued from* THE CHEMICAL AGE, *July* 6, 1946, *p.* 8)

AMONG the modes of phosphating the most common is the use of a bath or solution in which the finished article or unfabricated metal is immersed. But spraying, too, is largely used in the latest methods, also resilient rollers; and occasionally a phosphating preparation can be applied by brush, when structures or objects are too large for the bath. The fused salt bath method has been tried from time to time, as in B.P. 464,982, 466,661-2, of Rust-proofing Co. of Canada, Ltd. A fairly detailed review of the patent lierature up to 1934 was given by E. Rackwitz, of Berlin, in *Korr. u. Met.*, 1934, *10*, 58, supplemented by H. Högel, *loc. cit.*, 1941, *17*, 180. The history and development of phosphate coatings by R. C. Davies and S. J. Scouse mainly relates to the various processes of the Parker Rust-proofing Co. of U.S.A.: Parkerising, Bonderising, Spra-Bonderising, and the "D" process. (*J. Electrodep. Tech. Soc.*, 1943, *19*.) As this American firm strides like a colossus over the phosphating world some account of its rise and progress, as disclosed in the recent report of the case brought against it by the U.S. Government under the Anti-Trust laws, will be given in Part IV of this article, together with some of the main points in the company's infringement suit against the Norge Division of the Borg Warner Corporation.

Two Types of Bath

Broadly, the two principal types of phosphating bath are the iron-zinc and the iron-manganese, of both of which there are many varieties; and occasionally zinc and manganese are used together. While comparatively minor changes have taken place in bath composition from time to time—apart from accelerators—the major problem in recent years has been to shorten the time of processing by means of accelerating agents, by pressure spraying, and by the use of resilient rollers. These various methods are dealt with later in this article.

As we have seen (Pt. I, p. 6), Coslett in 1909 introduced zinc oxide or phosphate into the bath; and it was also used in the important German patents (Nos. 310,756, 313,578) of W. Schmidding, the special feature of which was the addition of other metals, especially calcium (as phosphide), and some manganese, cobalt, nickel, or lead, together with chlorates or other oxidising agents (accelerators). *See* also patents by Gen. Motors Corpn. (U.S.P. 1,856,261), Pacz (Fr.P. 728,411), Patents Corp. (U.S.P. 2,067,077; zinc pyrophosphate), and Castiglioni & Battaro (Ital.P. 347,354-5; for special steels; they include also some copper oxide, the use of copper in some form or other being a well-known feature of some phosphating baths).

It is clear also that the type of phosphating bath must be adapted to the kind of metal or alloy treated; different steels, for example, may require special solutions, as in Castiglioni's patent. The effect of various constituents in steels on the kind of phosphate, or indeed any other coating, has been emphasised by various well-known authorities, *e.g.*, Hedges & Jordan in their recent book on Tinplate, Adams & Dickinson in their paper read before the Iron & Steel Institute, etc.

Factors for Efficiency

Before going further it may be well to indicate some of the chief factors governing optimum conditions for producing an efficient phosphate coating on metallic surfaces. They are all essential, so there is no special significance in the order of setting forth.

(a) *Pointage*, or ratio of total to free phosphoric acid. If free acid is too low there may be increased sludge formation through hydrolysis, and if too high the iron surface is too vigorously attacked so that phosphating is retarded and coarser grained (Macchie, *Korr. u. Met.*, 1936, *12*, 211, and Domnitsch, *loc. cit.*, 223). But it is not correct to say, as Högel does (*Korr. u. Met.*, 1941, *17*, 180) that best results are obtained with one particular grade of acidity: it must, of course, vary according to circumstances. More or less standardised practice has now been determined for a large variety of materials, but the most skilled and experienced would hesitate to state beforehand what are the best conditions for a new alloy or other material: he could probably make a shrewd guess, but would wish to confirm by preliminary tests.

(b) Maintenance of proper *metal ion content* of bath, *i.e.*, by suitable and regular replacements or regenerators.

(c) *Temperature*.

(d) *Time of operating*: this usually varies according to the thickness of coating required. For example, the Parker Co.'s Bonderising and Spra-Bonderising yield a comparatively thin coating to be afterwards painted or enamelled, and require only

3-5 min., whereas the full Parkerising, giving a thicker coating, which may only require sealing with oil, may take up to 30 min. These two different treatments, formerly needing separate plants, can now be carried out in the same plant (the "D" process) by merely increasing time of operation for complete Parkerising (Davies & Scouse, *J. Electrodep. Tech. Soc.*, 1943, *19*, or *Tech. Bull.*, No. 55, of the Pyrene Co., Ltd.). Another factor is the purity of the water used, and yet others are connected with accelerating, spraying, etc.

An important step forward was achieved by R. G. Richards and M. A. Adams, of Coventry, in introducing the use of manganese phosphate (B.P. 17,563/1911). This was further developed by subsequent workers, especially the Parker research staff, W. H. Allen and others. *See* Parker's first British patents (Nos. 270,679-80, 270,820, 273,168, 346,401, 350,559). In these the importance of pointage is emphasised, also the ratio of manganese to iron in the bath, and the much more resistant coatings obtained with manganese. One of them (270,820) appears to be first for preparing the well-known Parker salts in solid and stable form for subsequent use, using ferromanganese as raw material, as also in 270,680. Battini, in Fr.P. 770,617, prepared his manganese bath by dissolving $MnCO_3$ in phosphoric acid, using a reducing agent to deal with the MnO formed; Tschurakov dissolved iron in phosphoric acid, with addition of manganese dioxide and permanganate (Russ.P. 36,126); and Garre & Kaspras used alkali persulphate and manganese phosphate solutions (G.P. 683,087).

Sulphate Addition

Sulphates are sometimes included in manganese and other baths: thus Waterfall, in B.P. 440.215, uses calcium, strontium, or barium phosphates, plus sulphates of zinc, manganese, or other, with or without complete precipitation of the calcium, etc., together with an oxidising agent such as nitrate (accelerator). The Curtin-Howe Corp. also uses sulphates (U.S.P. 2,132,000); and in U.S.P. 2,045,499 of the Met. Fin. Research Corp. (Parker associate) for the preparation of baths of manganese nitrate and phosphate they use a mixture of manganese phosphate, manganese sulphate, and barium nitrate. A further note on the Parker claims about the iron/manganese ratio may be added. They state that with increasing manganese content in the bath the phosphate layer is so much the richer in manganese and therefore the more rust-resistant; also the manganese is deposited in the coating more quickly than iron, and therefore regular and adequate replenishment of the Mn is important.

In the Atramentol process of I.G. Farben (B.P. 365,569; Fr.P. 698,878), acid solutions of manganese phosphate prepared by a special method are used. A temperature at boiling point is stipulated and the time required is 60-90 min.

Low-Temperature Phosphating

Copper compounds have been introduced in various patents and technical articles, partly for working at a lower temperature and also for other reasons. In B.P. 362,746 (or U.S.P. 1,791,715) Parkers use boiling solutions containing copper; and acid copper phosphate in Fr.P. 680,946, and some of their other patents. In B.P. 346,401 they claim copper phosphate as accelerator. In B.P. 390,834 the Met. Fin. Res. Corpn. includes copper nitrate, presumably as accelerator, and if any metallic copper appears in the coating it must be oxidised by heating, which would seem to detract from the value of the copper additions. In B.P. 427,921 the same firm uses copper carbonate; and in B.P. 438,816 H. T. Davies claims phosphating after pre-treatment with a copper salt and zinc salt, with acceleration by means of electric current—an old device already anticipated by Coslett, but usually not very effective. In U.S.P. 1,949,090, Met. Fin. Res. Corp., with a high pointage of 31 and the presence of a copper compound (one-fifth the amount of phosphate), plus also copper nitrate as oxidiser, claims that phosphating can be done in a few minutes at room temperature.

In more recent work on low-temperature operation various methods have been adopted. Some of the solutions used by the I.G., though not precisely recent, claim the addition of organic nitro-compounds, sulphites, etc., for low-temperature working (Fr.P. 773,554, 776,042, 836,140, with addition 50,154, and 801,033). In one of their early pressure-spraying patents (B.P. 473,285), the Pyrene Co., Ltd.—associates of Parker—claim a lower working temperature of 65°-75° C. using an accelerator; and in B.P. 550,751 of Am. Chem. Paint Co. lower working temperature, with accelerators and pressure-spraying, is claimed.

Pre-cleaning in fairly hot solutions and also pressure-spraying both have a warming effect on the metal surface and facilitate, it is said, low-temperature working. *See* B.P. 554,654 (Am. Chem. Paint) and 551,261 (Parker). Low-temperature operation of phosphating baths has been dealt with in some detail by Schuster & Krause, of the Metallges. A.G., Frankfort (*Korr. u. Met.*, 1944, *20*, 153), and in their cold Bonderising patent, G.P. 741,937, for coating iron, steel, and zinc. They indicate the main essential factors: *p*H value of solution, metal phosphate and other constituent concentration, choice of suitable accelerator, and auxiliary accelerator and concentration thereof.

It was an obvious advantage to speed up

the phosphating process, especially in the old days when it took nearly three hours; and attempts to do so have been continuous almost from the start. Coslett himself hoped that the auxiliary use of the electric current might help in this direction, and later on introduced boric acid into his solution with the purpose. Progress since has certainly been impressive, for, as already stated, by the most up-to-date methods and plant, phosphating of a much better quality than hitherto can be accomplished in a few seconds. Generally it may be said that the principal factor in accelerating has been thought to be the removal of the hydrogen formed, or possibly also other products, by oxidising them as fast as they are formed; so that the accelerators added to the bath have usually been oxidising agents: nitrates, nitrites, hydrogen peroxide, copper compounds, etc. But there are also other conditions to take into account, and the matter is not quite as simple as is sometimes pretended. As we have seen, for example, in the Westinghouse Electric patents, some form of intermediate bonding or activating film, or Parker's electrolytic iron, appears to have a marked accelerating action. Catalysis too has been invoked, as well as the action of colloids, wetting agents, etc. All the mysteries and complications of surface chemistry and physics, in fact, may be involved, and there is still much to learn.

Inorganic Accelerators

In one of the numerous early patents of W. H. Allen, *e.g.*, U.S.P. 1,287,605, oxygen-yielding salts such as sodium or potassium bichromate, permanganate, or other are added. W. Schmidding uses compounds yielding hydrogen peroxide; W. H. Cole employs chromates or bichromates, and sodium borate. Of the many users of nitrates probably the Met. Fin. Res. Corp. in B.P. 386,739 is among the first. But there is little need to go into detail over these earlier attempts. They have for the most part become obsolete in their original form, though nitrates are still popular. In the improved Bonder method of the Metallges. a zinc nitrate is added and the time required is 2-5 min. In the Pyrene Co.'s B.P. 473,974 nitrates are used together with phosphates of zinc, manganese, calcium, cadmium, or barium. Nitric acid is added to the bath and reacts with the precipitated insoluble phosphates, forming soluble nitrates and free phosphoric acid; and in their B.P. 514,443 the same firm proposes the addition of nitrite to oxidise ferrous ions. In some of their patents the I.G. has proposed the addition of zinc dust, also organic nitro-compounds, such as toluidine, pyridine, etc., and sulphite-yielding compounds to oxidise ferrous iron to ferric, as proposed also by the Curtin-Howe Corp. in U.S.P. 2,121,520. The addition of various organic compounds is frequently proposed: Prod. Chim. T.B.I. (Fr.P. 836,140, and addition 50,154); Soc. Continentale Parker (Fr.P. 849,856); Kahn (Fr.P. 851,541-B.P. 507,355); and Du Pont (B.P. 478,338).

Some Organic Types

An interesting suggestion in this class is the Pyrene Co.'s nitroguanidine patent (B.P. 510,684) with or without addition of copper or zinc nitrate: picric acid, hydroxylamine, and trichloracetic acid are also claimed as good accelerators. The same firm in B.P. 514,443 (communicated by Parker) as addition patent to 386,739, proposes addition of extra nitrite to oxidise ferrous iron or control nitrite formation from nitrate, or both, *i.e.*, adding nitrate from which nitrite is generated. And in B.P. 517,049 they suggest addition of a copper, nickel, iron, or other metal accelerator as particularly advantageous in conjunction with a nitrate. Time of operating is said to be one minute; but in this case spraying assists acceleration. In B.P. 519,823 (Parker through Pyrene) two kinds of accelerator are distinguished: (a) the oxidising type, such as nitrate, nitrite, or sodium sulphide, and (b) the nitro type represented by nitroguanidine, etc.

The Parker B.P. 551,261 is of interest in giving a general review of the progress of accelerating technique, first with copper compounds, then with oxidising agents, and thirdly by spraying—down to one minute for motor-car parts. This particular invention claims special merit in the combined use of chlorates with a nitrate, which is said to give unexpectedly good results, including operation at a lower temperature as well as acceleration. The specification is of further interest in discussing various theories, as well as the effect of pre-cleaning on the subsequent coating. Coatings formed, for example, are claimed to be very fine-grained and thin, but may be coarser-grained if the surface has been pre-cleaned with strong alkali. An alkali cleaner of the emulsion type is recommended. Incidentally, this type appears to be gaining ground.

Mechanical means to increase acceleration are spraying and the use of resilient rollers. Spraying has for long been suggested as an alternative to brushing or dipping; and while in some cases any kind of known spraying method may be used (Am. Chem. Paint Co.'s B.P. 501,739) in others a special form of spraying, using a fairly definite pressure, is recommended, as in the A.C.P. Co.'s B.P. 495,098, wherein a speed of 17 ft. per sec. and pressure up to 20 lb. is proposed.

The use of spraying and resilient rollers combined has been often claimed of late in connection with the phosphating of metal

sheet or strip which is to be afterwards fabricated into cans or containers or the like, *e.g.*, as substitute for tinplate, as in the Parker B.P. 554,734, 557,846, 561,504, 561,670. In the first two of these another novel feature is the inclusion of a bonding film, for example by preliminary galvanising before phosphating. This first coating of zinc is said to require only 30 sec. and the subsequent phosphating no more than 15 sec. Quicker working and also improved quality of coating (finer-grained) is said to be aided by means of rollers; and in 557,846, where chlorate plus nitrate plus copper accelerators are used, with or without preliminary galvanising, a further "tremendous accelerating effect" (total time 5-10 sec.) is achieved with resilient rollers. Here again, too, a pre-cleaner of the emulsion kind (kerosene) is recommended.

It has long been agreed that the underlying theory of acceleration is by no means completely summed up in the one word "oxidation" or the addition of oxidising agents only. As already pointed out, surface chemistry and physics are much more subtle and complicated than that. Although not strictly a phosphating process, nor indeed mainly dealing with acceleration, the Ford Motor Co.'s B.P. 563,025 is directly of interest in again suggesting the possibility of some form of activating or catalytic action in coating processes. In that specification is claimed a method for treating zinc or cadmium surfaces by (a) formation of bright lustrous durable surfaces which will take a protective coating, and (b) applying a transparent coating which adheres to the polished surface. Various ways of brightening were already known, *e.g.*, dipping the zinc plate in chrome and sodium sulphate solution: but the present invention covers immersion in a chromic acid bath containing minute amounts of sulphuric and nitric acids, and includes a theoretical discussion of surface phenomena involved with the suggestion that the action of the combined acids in minute amounts may be catalytic.

Use of Catalysts

The introduction of catalysis is by no means new in this connection. About the time of Coslett's boric acid patent, or a little earlier, O. Bauer, in B.P. 226,776, had used an alkaline bichromate solution in the presence of a catalyst, and in B.P. 471,070 of the Hanson Van Winkle Munning Co. (U.S.) a special activating agent, *e.g.*, alkali cyanide, tartrate, or tannate, is claimed in a phosphate coating bath for iron and steel. In one or more of the numerous Sutton & de Brocq patents for coating magnesium and its alloys (not phosphating), *e.g.*, B.P. 510,853, an activator, such as alum, is included in the claims. And as we have already seen, the Westinghouse Electric also claim an activating effect in connection with their bonding or preliminary films, using a titanium compound (B.P. 560,847-8).

Into the theory of the subject, catalytic or otherwise, it is not possible to go further at this time. Reference may be made to the standard works of U. R. Evans and others on corrosion and surface chemistry; and possibly also to the rather lengthy disquisitions of the Austrian writer, M. Machu, in *Korr. u. Met.* and elsewhere.

Quality of Coatings

Machu has specialised in the study of the porosity and general quality of phosphate coatings, and in conjunction with Müller has evolved his well-known formula for determining porosity which, of course, is one of the principal factors in quality. A distinction has been drawn, for example, between zinc baths and manganese baths in regard to the fineness and compactness of the crystalline structure of the coating formed; and was particularly emphasised in the report of the Automobile Research Committee of the Institution of Automobile Engineers on the beneficial effects of chemical surface treatment, such as phosphating, in reducing scuffing or seizing of piston rings and gears (*see* also D. Mansion, *Engineering*, August 10, 24, and 31, 1945). In this work several different kinds of phosphating bath were tried, and it was found that the manganese type yielded for the most part comparatively thick and coarse-grained coatings, while those from the zinc baths were thin and fine-grained. Dürer and Schmidt, in Germany, in their work on the effect of phosphating on metal-working (deep-drawing and shaping), also distinguished between the finer-grained zinc and the coarser-grained manganese phosphate coatings (*Z. Ver. deut. Ing.*, 1942, *86*, 15; *Korr. u. Met.*, 1944, *20*, 161), especially from the point of view of paint, etc., adhesion.

Further details of phosphating in metal-working, etc., will be given in a subsequent section, and the above note on quality has been introduced here, because quality is undoubtedly dependent on acceleration—or duration of treatment—and on other factors; and because the quality of the coating and especially the nature of its crystalline structure plays a pre-eminent part in the adhesion, covering power, and durability of the subsequent finishing coats of paint or enamel. *See* Dürer and Schmidt (*loc. cit.*).

Phosphating solutions have now been developed which result in the production of uniform and complete coatings of a more satisfactory crystalline structure. Some of these developments used during the war have not yet been fully disclosed, but there is reason to believe that some interesting results will be available in the near future.

(*To be continued*)

Organic Compounds of Silicon

A Few Notes on their Uses

by A. E. L. JERVIS, Assoc.I.E.E.

THE industrial applications of the silicon ester, ethyl silicate, are of increasing interest. The literature on this subject has been fairly extensive, and as recently as March, 1945, Shaw and Hackford[1] summarised *Developments in the Application of Silicic Esters*. At the outset it is worth while to record the following uses of ethyl silicate, *viz.*: as a preservative for stone, brick, concrete, or plaster, in weatherproof and acidproof mortars and cements, refractory bricks, heat-resisting paints, chemical-resistant paints, protective coatings for industrial buildings and in lacquers and bonding agents.

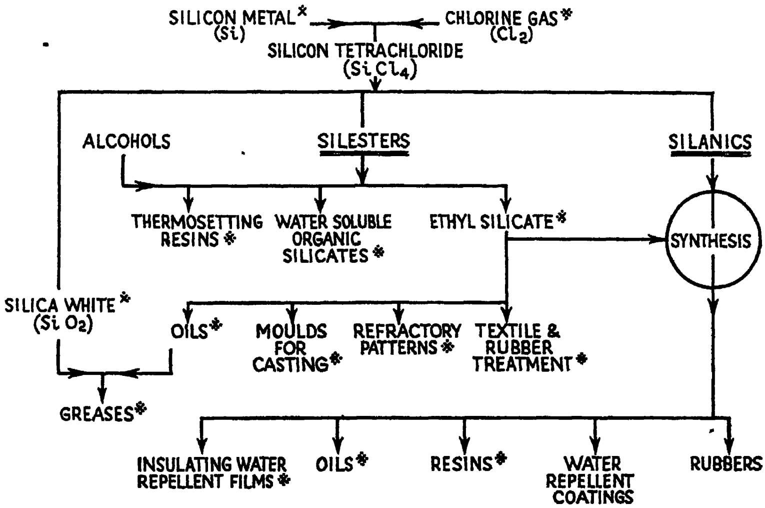

Fig. 1. Organic compounds of silicon. Products available in this country are marked with an asterisk.

The "tree" shown in Fig. 1 is intended to give a quick impression of various products (marked with an asterisk) already available in this country, some of which are considered very briefly below. Fig. 2 shows a portion of the plant of Silicon (Organic) Developments, Ltd., used for the production of ethyl silicate.

Silica White

Silica white is of considerable interest. It is a very finely divided form of silica, having a particle size of 1×10^{-5} mm. It has been suggested as a reinforcing agent for those rubbers and plastics where its pure whiteness is an advantage. Other characteristics, such as high electrical insulation properties and high impact strength, follow. In the case of rubber, experiments suggest that silica white produces characteristics comparable to those obtained with carbon black. Silica white is also offered as a general thickening agent, for liquids and in particular for aggressive liquids. Experiments have been conducted with strong hydrochloric and sulphuric acids. It is also suggested as an inert base for high temperature greases.

Silesters

Silesters 1 and 2 are liquids comprising partially hydrolysed stable ethyl silicate and a condensing agent. Their fluidity enables them to penetrate well into porous substances and the method of application is by brush or spray. Two Silesters are already available: "Silester 1" will "cold set" in 60 to 75 minutes, and "Silester 2" will "cold set" in 20 to 25 minutes. Depending on the absorbent nature of the material under treatment, one pint of Silester will treat one to two sq. yds., and it is interesting to note that the price is sufficiently low to make preservative treatment of stonework and damp proofing, etc., a commercial proposition. Surface treatment based on mixtures containing ethyl silicate have a wide appeal. One of the latest inquiries comes from Barbados and deals with a novel subject, namely, the protection of coral walls. It is hoped at a later date to give details of the results of the experiments undertaken.

Silester fluids are being developed over a wide range of viscosity for use as heat-transfer media, shock-absorber fluids, and pressure-transmitting fluids. Film-forming, thermo-setting resins are also being developed. Some of the potential uses are

for high-temperature lacquers, electrical varnishes, mouldings, and laminates.

Silanic fluids and resins are characterised by temperature stability and excellent electrical properties. They are suggested for electrical insulation, especially at high frequency, and as lubricants at high or low temperatures. The Silanic resins are thermo-setting and are appropriate for use as high temperature lacquers, electrical varnishes, and in cable insulation, plastic mouldings, and laminates.

The applications of silicon ester cements are numerous and in a short article of this nature it is possible to deal with only one of them, though it is hoped in a subsequent article to deal with other applications. The electrical insulation field, for instance, is of intense interest.

Precision casting is the application chosen, and Figs. 3 A-G show various examples of silicon cement moulds and the metal castings produced. The articles illustrated were recently exhibited at the Welsh Industries Fair, Cardiff, by Mr. Noel Shaw, of the Samuel Osborn Research Laboratories, Newcastle-on-Tyne. The limitations of plaster of Paris are well known, and the reader will therefore be interested in the refractory moulds shown in the photographs, some of which have stood up to temperatures as high as 1600° C.

Precision Casting

There are various methods of precision casting. Reference will be made to one only, namely, the lost wax (*cire perdue*) process. Apparently, this process was used by the Chinese and the Greeks many years before the Christian era. Centuries later it was rediscovered. Some suggest that the inclusion of the word " lost " in the title refers to the fact that the process was lost for a time, but others suggest (with much greater probability) that it refers to actual loss of wax during the process.[2]

It has been known for some time that refractory bodies can be obtained by binding a filler, *e.g.*, sillimanite, by means of a silicon ester, *i.e.*, the product of silicic acid and an alcohol. Ethyl silicate, for example, will react with water under certain conditions to form a strong gel of silica and will bind the sillimanite together. The mould or form produced can then be baked into a strong, hard article capable of standing up to temperatures as high as 1600° C., when molten metal is poured.

There is little dimensional change during the mixing and firing, and so it is possible to take a master metal pattern and surround it with a mixture of ethyl silicate and sillimanite which, when set and subsequently fired, can be used to produce metal castings of astounding accuracy and smoothness of finish. It is claimed that this method has, in certain instances, made possible the production of components, unmachined and yet accurate within a tolerance of ± 0.002 in. per

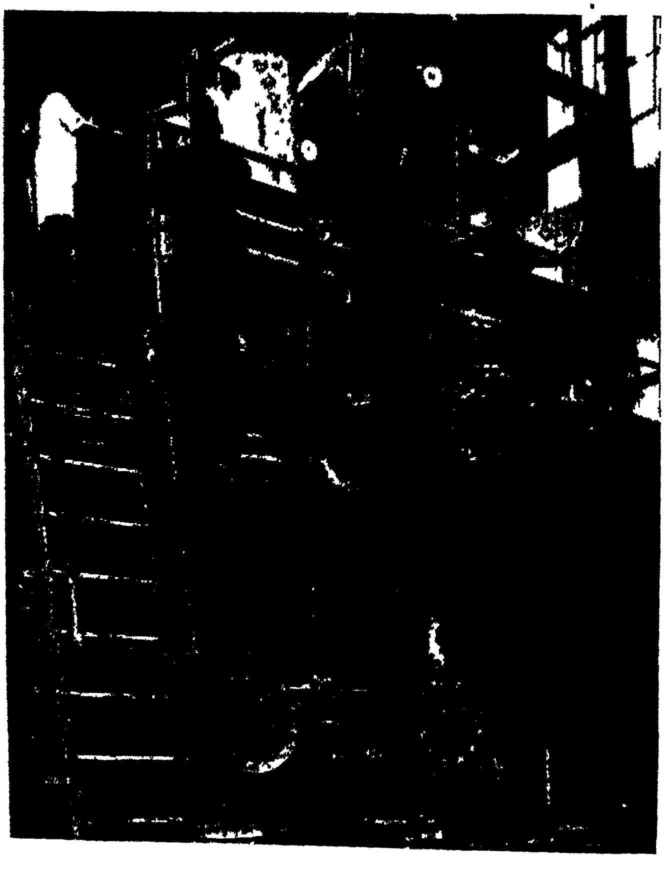

Fig. 2. Part of the ethyl silicate plant at Bridgend.

Fig 3. Silicon cement moulds and the metal castings produced.

A Precision casting (lost wax process) metal patterns for coal cutting bit B Refractory mould for the above C Steel mould and refractory mould for glass dish D Untouched precision cast unions in Stellite, brass, and stainless steel E Precision castings in brass and steel, untouched F Refractory moulds for glass dish G Cast test pieces in aluminium and brass with refractory mould

lineal inch, an accuracy which would have been extremely difficult, if not impossible, to produce by other methods

Castings have been produced from various metals including carbon and low-alloy steels, cast iron, aluminium, and bronze, and other non-ferrous alloys Certain alloys (machine-tool metals, Stellite, and Nimonic, for example) are very obdurate and would have been difficult to forge or machine

Precision casting is now definitely out of the experimental stage and has reached the development stage[3] Where the job does not warrant tooled automatic machine

(Continued on p 47)

Visible Flow Indication

New Sight Glass

IN all steam generating and process plants it is extremely valuable to have visible indication of flow in pipe lines, and this need has been met by the Drico sight glass made by the Drayton Regulator & Instrument Co., Ltd., West Drayton, Middlesex.

A Drico single-sided sight glass is shown in Fig. 1; this is suitable for observing the

Fig. 1.

flow of steam traps, thereby completely eliminating steam losses due to imperfect action of these important fittings. The double-sided sight glass shown in Fig. 2, fitted with an eccentrically mounted flap,

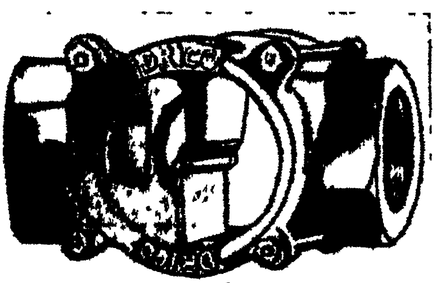

Fig. 2.

has been specially designed for indicating the flow of clear liquids; it can be employed only in horizontal pipes, whereas the other type can be used either in a horizontal or vertical position. The flap is not required for opaque liquids.

Sight glasses with flaps are normally made in cast iron only, screwed up to 2 in. and flanged from 1½ to 3 in. The other models have 1¼-in. dia. windows in the ½-in., ¾-in., and 1-in. sizes, and 3¼-in. dia. windows in the larger sizes, the bodies being made either in cast iron or gunmetal, with screwed sizes ranging from ½ in. to 2 in., and flanged sizes from 1½ in. to 3 in.

The Testing of Glues

Amendment to British Standard

THE British Standards Institution has just issued amendment No. 2 to B.S.647, Methods for Testing Glues (bone, skin and fish glues). The original specification, published in 1935 and revised in September, 1938, was well received by works chemists. The adhesives dealt with are used in many industries, though often in comparatively small amounts, and until this publication was issued, information on the subject was very scattered and neither here nor abroad was there any uniformity in testing.

The revisions, issued as amendment slips to be attached to the 1938 edition, present no fundamental changes, but some useful additions are to be noted. The Bloom jelly strength test has been set out in greater detail, in order to make clear the technique which should be followed. The temperature at which viscosity is to be determined has been raised to 60°C. to bring it in line with American practice and the unit has been changed from centipoises to centistokes—a simplification which cuts a density determination. An alternative tensile strength determination, using beech slips instead of walnut test pieces, now difficult to obtain, is set out in detail.

Copies of the specification and amendment slip are available from the B.S.I., Publications Department, 28 Victoria Street, London, S.W 1 (3s. 6d. and 6d. respectively).

Thermal Insulation

British Standard Specification

FUEL shortage and fuel cost are receiving increasing attention, together with the need for improvement in the standard of thermal insulation provided for the conservation of heat.

The British Standards Institution is preparing a series of specifications for thermal insulating materials, embracing pre-formed, plastic, granular, and loose-filled types. The first of this series is B.S.1304, and carries the title "Ready-to-Fit" Thermal Insulating Materials for Hot and Cold Water Supply and Central Heating Installations for dwellings with a Water Heater rated at not greater than 40,000 B.Th.U. per hour. It is intended for use in connection with small dwellings, and it is hoped that its issue will assist manufacturers in the mass production of materials suitable for this purpose.

The fuel saving to be achieved by the installation of thermal insulation in such dwellings is emphasised in an appendix. A list of suitable materials with information concerning thermal conductivity is also given. Copies may be obtained from the B.S.I., as above (2s.).

Polymerisation of Styrene*

Experiments with High-Frequency Currents

NONE of the substituted styrenes so far investigated has given a polymer of significantly improved properties. Substitution in the side chain sometimes prevents polymerisation, while substitution in the benzene nucleus, although tending to raise the coefficient of polymerisation and the thermal stability of the product, does not have sufficient effect to justify the use of such difficultly obtainable monomers. It appeared possible, however, that an entirely different method of polymerisation, based on the use of high-frequency currents, as used on an industrial scale for the sterilisation of milk, etc., might reduce the influence of the factors which tend to break the reaction chain.

As is well known, thermal treatment accelerates the process but at the same time lowers the average molecular weight. The chain reaction is broken earlier, according to Staudinger, the higher the temperature of polymerisation. In the case of H.F. currents there is a thermal effect, but heating occurs from inside as well as outside, so the conditions might be more favourable for the preparation of high polymers.

The first experiments, with decimetre waves, were not encouraging, since the molecular weight was reduced, as shown in Table 1.

The molecular weight was less, by about 30,000, than that of the auto-polymerised sample. Further experiments, as shown in Table 2, indicated that this result was probably due to the presence of the oxygen in the atmosphere, since styrene in carbon-dioxide-filled ampoules gave products of higher molecular weight in the H.F. field than in the control. Atmospheric oxygen is activated in a H.F. field and oxygen ions and ozone may be formed which would tend to oxidise the end-groups and form ozonides at the double bonds, thus exerting an adverse influence on the creation of active centres for polymerisation.

It appears, therefore, that waves of less than 1 m. can effect a substantial increase (50,000) of the molecular weight of the polymer, in spite of the increase of temperature occurring during the treatment. The last experiment in Table 2 was carried out under conditions which maintained a lower temperature, and the molecular weight of the product was still higher. It was further noticed that the yield of the high polymer fraction in the H.F. field was three or four times as great as that of the control; the rate of polymerisation is thus increased.

Experiments have been carried out also with metre waves. In this case, however, whether the process was operated in air or in carbon dioxide, the molecular weight of the fraction separated by means of alcohol was equivalent to that obtained in thermal polymerisation at 100°. It is considered, therefore, that metre waves serve merely as a source of thermal energy.

TABLE 1.

Polymerisation of styrene in a H.F. field in air.

Time of treatment (hr.)	Time of polymerisation (days)	Molecular weight of alcohol-insoluble
0 (auto-polymn.)	60	206,232
2		204,562
4		171,860
6		173,495
8		173,495

TABLE 2.

Polymerisation of styrene in a H.F. field in CO_2.

Time of treatment (hr.)	Time of polymerisation (days)	Molecular wt. of alc.-insol.	Position of ampoule
0 (auto-polymn.)	80	254,222	In the dark, at room temp.
8		298,769	In the field
8		300,046	do.
8		327,322	In the generator

* From a paper by N. V. Shorygina and E. I. Petrova in Russian. (*J. Gen. Chem. Russ.*, 1945, *15*, 173).

Tetrafluoroethylene Polymer

Du Pont's New Plastic

PRODUCTION details concerning " Teflon," the tetrafluoroethylene polymer developed for war purposes by Du Pont's, are included in a recent note in *Chemical Industries* (1946, 58, 781), special stress being laid on the unequalled chemical inertness of this plastic, and its excellent electrical and heat-resisting properties.

The discovery of " Teflon " is said to have taken place in the course of refrigerant research by Kinetic Chemicals, Inc., a partially owned subsidiary of the Du Pont company. The gaseous monomer, which boils at $-78°$C., was prepared as an intermediate and stored temporarily in a steel cylinder. Later, when the gas was used, it was noticed that only one-third or so of the material was released before the pressure fell to zero, and the tare weight of the cylinder was high. Suspecting what might have happened, the research men cut the cylinder open and found the insoluble, infusible white powder which was the first " Teflon."

From the chemical composition and physical nature of the polymer, it was clear that the substance might find useful applications in the field of plastics; and, consequently, a patent was applied for and obtained (U.S.P. No. 2,230,654), and development of the plastic was taken over by the Plastics Department at Arlington, N.J. Pilot-plant production was undertaken in 1943 for war uses under strictest secrecy. It is still only in the pilot-plant stage, but it is available for evaluation.

In thin sections this plastic is transparent, but in thicker pieces it is waxy in appearance and white or grey in colour. It is remarkable for its toughness over a wide range of temperatures, its excellent electrical properties over a wide range of frequencies, its extreme chemical inertness, and its high heat-resistance.

Physical and Chemical Properties

With no true melting point, it undergoes a solid-phase transition to a gel at 325°C. with a sharp drop in strength. In the neighbourhood of 400°C. it decomposes slowly to yield the gaseous monomer plus a few other gaseous fluorine derivatives. Small amounts of fluorine-containing gases are given off at temperatures above 215°C.

The chemical resistance of " Teflon " is outstanding, in that it withstands the attack of all materials except molten alkali metals. It can be boiled in *aqua regia*, hydrofluoric acid, or fuming nitric acid, with no change in weight or in properties. It also resists the attack of organic materials and strong alkalis. Since it can be used over the temperature range $-75°$C. to 250°C., its employment as a gasket and packing material and as tubing for chemical process work is suggested.

So far no plasticiser has been found for the material since at the high temperatures at which " Teflon " finds its special niche, plasticising materials would volatilise out.

The excellent electrical properties of " Teflon," coupled with its heat-stability, give it many potential applications in the power field, where one of the limiting features in design of electrical equipment has been the lack of a suitable insulating material that will withstand high temperatures.

" Teflon " can be extruded in the form of rods and tubes or as a wire-coating, and compression mouldings of simple articles can be made by using special techniques. Sheets and thin films are made by shaving baked blocks and cylinders. Extrusion rates vary, but all of them are measured in terms of feet per hour, which is slow when compared to those of other thermoplastics.

Technique of Machinery

Until moulding techniques become fully developed, it is necessary to form articles of complicated shape by machining standard shapes. The material can be machined easily with standard wood-working or metal-working tools as long as they are kept sharp. Sheet stock can also be worked on a punch press. Thin-walled tubing can be flared by standard flaring tools as used for copper tubing, and heavy tubing can be threaded by standard pipe-threaders.

The field for tetrafluoroethylene as a plastic will always be limited. For applications which can take advantage of its unique properties, however, it is bound to find a ready, but special, market. Its only near competitor, for example, in the manufacture of electronic parts subject to high frequency current and high temperature, is the silicone group of resins.

Present production approximates to 10,000 lb. per month, and the price is from \$12-\$15 per lb., but large-scale production may bring the price down to \$2.50 per lb., though even then it probably will compete exclusively for the aforementioned special purposes.

Meanwhile, development is in progress to extend the usefulness of " Teflon." Organic fillers have been added successfully; dip-coating methods may prove feasible; and modifications are being studied in order to provide a material which can be more readily moulded on injection and compression machines.

German Assets in Spain

Strong Chemical Interests

(from a Special Correspondent)

THE extent to which Germany has succeeded in penetrating the whole economic structure of Spain, and in particular the Spanish chemical industry, has been strikingly revealed in a memorandum prepared by the U.S. Government for submission to the United Nations Security Council Sub-committee on Spain.* In addition to a thorough survey of the magnitude of German assets in Spain, the memorandum contains details about the obnoxious anti-Allied activities of Nazi agents, as well as a chapter on the Spanish war potential. Even a cursory reading of this document leaves no doubt that Nazi authorities, commercial interests, and individuals, have received and continue to receive a strong measure of support from the Franco régime which, even a full year after Germany's unconditional surrender, hesitates to extradite known Nazi agents.

Intensive Penetration

The fact that Spain had been penetrated by Germany before and during the war has, of course, been known to H.M. Government. In the spring of 1944, Mr. Dingle Foot, Parliamentary Secretary to the Ministry of Economic Warfare, stated in reply to a question by Mr. Alfred Edwards that "he had received considerable evidence of German infiltration into Spanish industry in the form of making available patent rights and supplying technical plant, advisers and engineers."

To summarise the general observations on German assets in Spain given in the American memorandum, German property in Spain known to the U.S. totalled $95,000,000. However, it is quite likely that there is a large amount of still hidden property. Out of this total, about $80,000,000 are invested in Spanish industry and, according to the Spanish financial directory, the *Anuario Financiero y de Sociedades Anónimas de España*, German investments amount to about 3¼ per cent. of the total. However, this percentage figure may easily give an entirely wrong impression because it stands in no relation to the influence of German interests in several important industries. The breakdown of the $80,000,000 invested in industry is as follows: $45,000,000 are held by private German companies, while the remaining $35,000,000 are in the hands of the German State-owned "Sofindus" organisation, which embraces about 25 participating companies, under the direction of the Ministry of Economics.

* Published and distributed in the U.K. by the U.S. Information Service, Room 311, Davies Street, London, W.1.

Chemical Industry Controlled

Referring to German assets invested in the Spanish chemical and pharmaceutical industry, the American memorandum states that they amount to about $8,000,000. The I.G. Farben, through a number of Spanish subsidiaries, and by control of patents and manufacturing processes, had, until the collapse of this German chemical empire, a genuine grip on the Spanish chemical industry. Other companies with important investments are Schering, Merck, and Boehringer.

To describe briefly the activities of the leading German-controlled chemical companies in Spain, the Unicolor S.A. distributes the chemical, pharmaceutical, and dye products of the I.G. and its subsidiaries. At the end of 1944, it had assets totalling $4,400,000. The import of aniline colours by this company represented approximately 60 per cent. of the total Spanish imports during most of the war. The fertiliser business of Unicolor was based almost exclusively on imports from Germany and former German-occupied countries. Although the company no longer receives supplies, its organisation is still intact. The sale of chemical products has been extremely profitable to the firm, but with the loss of foreign supplies, its volume of business has naturally dwindled. Another company, the Fabricación Nacional de Colorantes y Explosivos, S.A., is engaged in the manufacture of dyestuffs, chemical fertilisers, and coal-tar products for textiles, and is closely connected with Unicolor, through which it is controlled by I.G., the latter holding 50 per cent. of the capital stock of $2,750,000 At the end of 1944 assets totalled $5,700,000, and the company still uses technical processes of the I.G. The main offices are in Barcelona and there are factories in four other Spanish towns. Although most of the directors are Spanish, technical matters are in the hands of German experts who received their training in most instances in I.G. plants. The company is the only large-scale producer of dyes in Spain, the entire output being supplied to the home market. In spite of its title, the company does not engage in the manufacture of explosives, because this field of activity has been ceded, by agreement, to another I.G.-controlled unit, the Unión Química del Norte de España. This company (with a capital of $5,540,000) is one

of the largest chemical producers in Spain. Its wide range of products includes ammonia, phenol, methanol, and other alcohols, plastics, and inorganic compounds.

The Electroquímica de Flix, S.A., is one of the largest Spanish manufacturers of caustic soda, sodium sulphate, liquid chlorine, and ammonia. It owns land and a factory at Flix, Tarragona, where it employs some 700 people. Another German-controlled unit, the Cloratide, S.A., which formerly manufactured and sold explosives and related products, is now engaged in coal mining.

Pharmaceutical Interests

To make brief reference to German pharmaceutical interests, La Bayer Química Comercial y Farmacéutica, S.A., distributed I.G. products under the trade mark "Bayer." It has enough semi-finished products on hand to last about four years at the present rate of sale. The annual volume of business aggregated about $13,600,000, and it is believed that the company has made exorbitant profits, which are not revealed in the books. These secret profits, a prominent official of the Spanish chemical industry stated, have been used by the German Embassy for its nefarious activities. The subsidiary of Merck, Productos Químicos Farmacéuticos, S.A., also disposes of large pharmaceutical stocks. The Boehringer S.A., owned by Boehringer Brothers, of Mannheim, supplied quinine and other special products to the Spanish market, while the Schering group owned four subsidiaries in Spain, the chief of which is Productos Químicos Schering, S.A. Before the war, this was essentially a sales organisation, but later it established an important laboratory in Madrid for the finishing of imported chemicals. Another small concern is the S.A.L.I.A. Productos Químicos Farmacéuticos, S.A., owned by the Diwag Chemische Fabriken A.G., of Berlin.

Mining Interests

The high strategic importance of tin and wolfram led to a keen scramble for supplies between the Allies and Germany, euphemistically termed "pre-emptive purchases." Spanish ores, of course, played a vital part in German armament production, and the U.S. memorandum states that during the war, the "Sofindus" group purchased a number of tin, wolfram, and iron mines at highly inflated prices. It is estimated that these mines cost the Germans about $10,000,000, whereas their present value is about one-fifth of that sum. At present, of six companies, holding 42 mines, only seven are operating—one lead mine, and six tin mines. Another important metallurgical concern, Lipperheide y Guzman S.A., owned by two of the leading German families in Spain, is a large-scale producer of non-ferrous metals. In 1942 its foundry produced metals of the value of $4,000,000. German members of the firm participate in the management of about ten other mining and smelting companies. Rheinmetall-Borsig and Röchling Stahlwerke also had subsidiaries in Spain.

Allied Control

Even before Germany's defeat, the British and U.S. missions in Spain pressed the Franco Government to turn all German property over to the Allies. In May, 1945, their efforts met with partial success, when all German assets were blocked and a census prepared. However, this census proved to be entirely inadequate for it failed to reveal German interests of which the Allies had definite knowledge. But as a result of determined insistence on the part of the American and British missions, later on supported by the French, known official German assets in Spain came into the physical possession of the Allied Joint Trusteeship, established early in the summer of 1945. By early February, 1946, the Trusteeship had taken possession of official funds valued at $3,000,000. It also took over control of 22 companies of the "Sofindus" combine, as well as buildings and valuable equipment. Large numbers of German and Spanish personnel were dismissed from these companies. Plans have been made to sell the remaining enterprises to non-German interests.

Yet the United States memorandum makes it abundantly clear that the Franco régime has offered hardly any assistance to the Allied missions, because constant pressure had to be exerted over each individual German asset. Furthermore, the Spanish authorities have consistently refused to co-operate in a programme of "unmasking German dummies." In April last, the Franco Government openly refused to agree to the sale of German State-controlled properties and requested that matters with regard to German property in Spain should be left in abeyance until over-all negotiations had been completed. These negotiations are to take place in Washington in the near future, it is stated. On the boards of private German companies, the Allies have secured the appointment of their nominees, a measure against which the Spanish also officially protested. While not openly prohibiting the Trusteeship's activities, the Spanish authorities advised their citizens not to co-operate with the Allies. The Spanish Government, while recognising the Allied Control Council as the *de facto* German Government, refuses to recognise its *de jure* status, and therefore also the so-called "vesting decree" of October, 1945. However, there is little doubt that the Allies will not allow the continuation, in any form whatever, of Germany's powerful position in Spain's economic system.

Personal Notes

LORD HYNDLEY, chairman-designate of the National Coal Board, has resigned from the board of Powell Duffryn, Ltd.

SIR RICHARD PEASE has been elected president of the National Benzole Association in succession to the late Sir David Milne-Watson.

DR. H. K. WORNER, of the Australian College of Dentistry, has been appointed Professor of Metallurgy in the University of Melbourne.

DR. PETER KAPITZA is among the Russian scientists who are visiting Great Britain this month, and it is understood he will be at his old university, Cambridge, on July 22, when he will deliver a discourse on his recent work.

MR. H. WARREN, M.Sc., M.I.E.E., managing director of the B.T.-H. Company, and formerly director of the company's research and engineering, has received the honorary degree of D.Sc. at Birmingham University, principally in recognition of his work in industrial research and technical education.

MR. R. A. HACKING has resigned his position as a special director of Dorman, Long & Co., and has been appointed by Richard Thomas & Baldwins, Ltd., to deal with, and advise on, all that company's iron and steel production, including new construction and development.

DR. D W. KENT-JONES, the well-known cereals chemist, recently returned from a visit to the U.S.A., where he delivered a paper at the annual convention of the American Association of Cereal Chemists, held at Niagara Falls. He also addressed several other meetings and was guest of honour at a large number of dinners and luncheons.

SIR OLIVER FRANKS, who was formerly Professor of Moral Philosophy at Glasgow University, has been mentioned as the possible first chairman of the Steel Board. He was educated at Bristol and Oxford and on leaving Glasgow University in 1939 and going to the Ministry of Supply quickly rose to be Permanent Under Secretary. He was awarded the C.B.E. in 1942 and recently a knighthood in the Birthday Honours.

DR. CECIL L. WILSON, M.Sc., Ph D., F.R.I.C., lecturer in chemistry at the Sir John Cass Technical Institute, London, has been appointed to a lectureship in chemistry (with special reference to microchemistry) at the Queen's University of Belfast, with effect from October 1, 1946. This is a new appointment, made possible by a grant to the University by I.C.I. for a period of seven years, to aid research and teaching in microchemistry and glassblowing.

MR. JAMES GERSTLEY, who has been associated with Borax Consolidated, Ltd., since its inception in January, 1899, has resigned from the position of joint managing director. He retains his seat on the board, however, and will continue to act as consultant. MR. A. H REID, C.B.E., who has been a director for the past ten years, has been appointed to succeed him as joint managing director in conjunction with Mr. F. A. Lesser.

Organic Compounds of Silicon

(*Continued from p.* 41)

methods, it compares very favourably with older methods of casting. Some of the advantages claimed are: (1) direct labour charges reduced; (2) with tooling-up eliminated, the capital costs are reduced; (3) the equipment is remarkably versatile for work of new design.

The "lost wax" technique has been used to a large extent in the U.S.A. as well as in Great Britain. The procedure is briefly as follows:

(1) A master replica of the article to be produced is prepared.

(2) A bismuth alloy mould is formed round it in two or more sections in the conventional manner, leaving "gates" for pouring.

(3) The master replica is then removed and the cavity in the mould is evacuated under vacuum.

(4) The wax pattern is then produced by forcing wax into the cavity under pressure.

(5) The wax pattern is removed from the cavity and is sprayed with a fine fluid mixture of the refractory material, which is then allowed to dry off.

(6) A mould is then made around the wax pattern, using ethyl silicate, sillimanite, and controlling agents in slurry form.

(7) The slurry is vibrated for some time in order to remove air bubbles and is then allowed to set. The setting time depends upon the mass of the mould.

(8) The mould is then baked in order to melt the wax, which comes out through the pouring gates, and also to harden the mould.

(9) Molten metal can now be poured into the refractory mould.

(10) After the casting has cooled, the refractory mould is broken away and the casting trimmed.

REFERENCES

[1] SHAW and HACKFORD, *Ind. Chem.*, 1945, *21*, 130.
[2] A. DUNLOP, *Foundry T. J.*, 1945, *75*, 107.
[3] D. GREENSMITH, *Pract. Eng.*, 1946, *13*, 597.

Parliamentary Topics

Oil Seed Production

IN the House of Commons last week, Sir R. Glyn asked the Colonial Secretary whether, in view of the importance of niger oil as an alternative to linseed, any immediate steps could be taken to increase the supply to the U.K.

Mr. George Hall: Niger oil is produced from a seed which grows chiefly in India and Abyssinia though it also occurs in East Africa. It is very inferior to linseed oil and offers no commercial attraction as a substitute. I am actively encouraging the production in Nyasaland of tung oil which is an excellent alternative to linseed. Answering a further question by Sir R. Glyn, Mr. Hall stated: Linseed, rape seed and perilla are not produced within the Colonial Empire, with the exception of a small amount of linseed in Cyprus. Attempts to grow perilla, which normally comes from Manchuria, Japan, and India, have proved abortive. As regards soya and castor seed, I have asked the Governors of certain territories to encourage their production so long as this does not interfere with the production of even more valuable edible oilseeds such as groundnuts.

Glycerine in Paint Manufacture

Mr. Belcher, replying to a question by Mr. Bossom, stated: It is estimated that 295 tons of glycerine were used in paint manufacture in the first quarter of 1938, but it is not known how much of this glycerine was produced in the U.K. In the first quarters of 1945 and 1946, 215 tons and 538 tons respectively of glycerine, all produced in the U.K., were used in paint manufacture.

Linseed for Linoleum

Mr. Belcher, in answer to a question by Mr. Prescott, said the total allocation of linseed oil to the linoleum industry for the month of July was 195 tons a week, as compared with 250 tons in June and earlier months this year.

Basic Slag

Mr. Belcher, replying on behalf of the Minister of Agriculture to a question by Lieut.-Col. Thorp, stated that the quantity of basic slag which steel works could produce as high grade material was limited by technical considerations; and distribution had been affected by transport difficulties.

Molasses

In reply to a question by Brigadier Mackeson, Mr. Belcher said a farmer could obtain 10 cwt. of molasses in a season by giving a formal undertaking to his supplier that the molasses was to be used for silage. For larger quantities a permit must be obtained from the county agricultural executive committee. That requirement was necessary in view of the world shortage of molasses, and of the fact that molasses supplied for silage was in addition to the farmer's feed ration.

Use of Pig Lead

Mr. Leonard, in reply to a question addressed to the Minister of Supply by Major Lloyd, stated that the quantity of lead used for the manufacture of sheets and pipes in the first quarter of this year was 23,000 tons. The quantity used for this purpose in 1936, 1937, and 1938 was 180,000, 180,000, and 170,000 tons per annum respectively. In each case the figurs included sheets and pipes manufactured for industrial installations (chemical plants, etc.), but the greater builk would be for housing.

Ground Nuts

Mr. George Hall, answering a question as to whether investigations into the practicability of large-scale production of ground nuts would extend to other colonies than those in East Africa, said he was hoping for the team of experts now in East Africa to visit parts of West Africa for the same purpose.

Soap Substitutes

The Minister of Food, replying to questions as to the provision of substitutes for soap to the public, said he had already taken steps to encourage production and distribution of such products. More than 1000 firms had already been licensed to produce or market soap substitutes. He would see that reasonable prices were charged to the consumer, and he agreed that hard water districts should have preference in supplies.

Asked by Mr. Ward what steps he was taking to make greater use of coconut oil in the manufacture of cooking fat and soaps, the Minister replied that the highest percentage of coconut oil that was technically possible was already being so used.

Export of Tinplate

Mr. Marquand, replying to a question by Mr. Walker-Smith, stated that exports of tinplate last year amounted to 27,169 tons, as compared with 319,308 tons in 1938. All the tinplate being exported to-day was for food packing requirements related to the food import programme, except for small quantities used in the distribution of oil.

Iron Foundry Industry

Mr. Wilmot, replying to a question by Mr. W. Shepherd, stated that the present potential capacity of the iron foundry industry is 3,500,000 tons a year, compared with 3,400,000 in 1939 and 3,200,000 tons in 1943. Owing to shortage of labour, actual present production was at the rate of 2,300,000 tons a year. Everything was being done to increase the labour force.

German Technical Reports

Particulars of Latest Publications

SOME of the latest technical reports from the Intelligence Committee in Germany are detailed below. Copies are obtainable from H.M. Stationery Office at the prices stated.

BIOS 243. *I.G. Hoechst*, Inorganic Division: Manufacture of sulphuric acid, sulphite products and chlorsulphuric acid (3s. 6d.)

BIOS 256. *Phosphoric acid and sodium phosphates in Germany* (4s.).

BIOS 260. *I.G. Farben, Ludwigshafen*: Manufacture of sulphuric acid, sulphite products, liquid sulphur dioxide, and cyanides (4s.).

BIOS 296. *German non-ferrous copper base foundry industry* (11s.).

BIOS 375. *The wrought light alloy industry in the Ruhr* (6s. 6d.).

BIOS 392. *Welding of aluminium and aluminium alloys with particular reference to the manufacture of pressure vessels* (3s.).

BIOS 395. *German flourescent lamp industry and phosphor chemical manufacture* (8s. 6d.).

BIOS 402. *Rolled non-ferrous metal, industries in Germany* (9s. 6d.).

BIOS 419. *I.G. Waxes*: Manufacture at Gersthofen and Oppau (1s. 6d.).

BIOS 422. *I.G., Ludwigshafen*: Sodium hydrosulphite and related compounds (3s.).

BIOS 423. *Deutsche Gold und Silber Scheide Anstalt (Degussa), Frankfurt*: Report on organisation, research activities, and production of sodium cyanide, sodamide, and potassium ethyl xanthate (4s. 6d.).

BIOS 425. *A.G. für Chemische Industrie, Gelsenkirchenschalke* (a controlled subsidiary of the I.G.): Manufacture of carbon bisulphide (1s. 6d.).

BIOS 438. *German collapsible tube and extrusion industries* (2s. 6d.).

BIOS 445. *Investigation of German plastic plants. Part III. Processing of polyvinyl chloride* (12s. 6d.).

BIOS 468. *I.G. Farben, Oppau-Ludwigshafen*: The manufacture of synthetic crystals (1s.).

FIAT 170. *Animalisation and water proofing of cellulose fibres at Dormagen* (6d.).

FIAT 406. *Non-ferrous metal rolling mill practice in Germany* (3s.).

FIAT 437. *Stickstoff-Syndikat G.m.b.H., Ramholz über Vollmerz, near Schlüchtern*: Production and use of nitrogen fertiliser in Germany (1s.).

FIAT 480. *German wood preservatives other than coal-tar creosote for the war period* 3s. 6d.).

New Control Orders

Glue, Gelatine and Size

THE Glue, Gelatine and Size (No. 3) Order, 1946 (S. R. & O. 1946, No. 973), revokes and re-enacts with amendments the No. 2 Order of 1945. The amendments are:

1. Control is re-imposed on the supply and acquisition of animal glue, gelatin and size, and of adhesives in the preparation of which any such material has been used.
2. The quantity of animal glue, gelatine (other than edible) and size which may be used without a licence is reduced.
3. The treatment, use and consumption of fish glue is freed from control.

Under the new order, licences will be necessary to supply, or to acquire or to treat, use and consume, in any quarter, quantities in excess of (a) 5 cwt. for edible gelatine, or (b) 1 ton in the aggregate for gelatine other than edible, animal glue and size. The first quarter will run from August 1, 1946, to September 30, 1946; subsequent quarters from October 1, January 1, etc. Applications for licences should be made to the Board of Trade, Raw Materials Department (R.M.2C), I.C. House, Millbank, London, S.W.1.

Fertiliser Prices

The Control of Fertilisers (No. 31) Order, 1946 (S. R. & O. 1946, No. 975), which came into force on July 5, revokes and re-enacts earlier Orders governing fertiliser prices. The new Order provides higher prices for superphosphates and compounds containing ammonium phosphate but prescribes lower prices for all other compounds. All prices reflect the increased cost of transport. Rebates on deliveries af compounds payable during July/August/September* are increased by 10s., 7s. 6d., and 5s. respectively. Northern Ireland prices of compounds, superphosphates and ground phosphate are now brought into line with those ruling in the rest of the U.K. The Order also provides for certain other minor changes.

SAMPLING OF LEATHERS

A new British Standard Specification "Sampling and Analysis of Vegetable Tanned and Chrome Tanned Leathers," (B.S. 1309-1946) gives exact instruction as to methods of sampling, as well as diagrams showing from which part of the hide samples are to be taken. A full range of chemical tests is described. Both the methods of sampling and the chemical tests are those approved by the International Society of Leather Trades' Chemists. Copies of this Standard can be obtained from the B.S.I., 28 Victoria Street, London, S.W.1 (2s.).

Empire Scientific Conference

Report on Chemical Industries

SUMMING up the observations made at the Royal Society's Conference on the natural products of the Empire and the chemical industries that are, or might be, based on them, the "Steering Group," under the chairmanship of Dr. J. L. Simonsen, has made the recommendations which follow.

In view of the varied nature of the natural products of the Commonwealth, their wide geographical dispersal, and the diverse and often inadequate facilities in staff and equipment which may be available locally for their investigation, it is suggested:

(1) That a standing central committee, including representatives of the United Kingdom, the Dominions, India, and the Colonies, should be set up to advise on policy for the co-ordination of research, both scientific and economic, into the natural products of the Commonwealth. Such advice on their own particular problems would be made available to all Commonwealth countries with the minimum of delay.

(2) The Conference, while recognising the desirability of centralising research on problems common to many parts of the Commonwealth, supports very strongly the view that research into problems of more local interest should be co-ordinated within regions. This should lead to increased efficiency and economy in man-power. The Conference regards advice on the concentration or regionalisation of the research in question as an important function of the central committee.

Essay Competition

Newton, Chambers' Awards for 1945

AN award of up to £100 is made annually by Newton, Chambers & Co., Ltd., to members of the Royal Institute of Chemistry, for the best essay, or essays, on a subject related to the application of chemistry to industrial welfare.

For papers presented in 1945 to the adjudication committee of the South Yorkshire Section of the R.I.C., awards have been made to the following:

(1) C. A. P. Fagan, A.R.I.C. (of the Research Department, Marconi's Wireless Telegraph Co., Ltd., Chelmsford).

(2) D. A. B. Llewelyn (registered student, Leicester).

The first award when the competition was started was made to Dr. Stocken, of the team working at Oxford Bio-Chemical Laboratory, for his contribution to research on synthetics of therapeutic value, mainly in arsenical poisoning. For security reasons neither the title, nor the work, could be published during the war, but it is hoped that in a few months' time this paper will be read in Sheffield.

General News——————From Week to Week

One man was killed, and another injured, when an explosion occurred while they were drilling in the anhydrite mine of I.C.I., Ltd., at Billingham, on July 5.

Following the dismissal of some men owing, it is stated, to redundancy, employees of I.C.I. Metals, Swansea, decided to give seven days' strike notice.

Ministry of Labour statistics issued this week show that in the chemical industry the number of insured workers employed totalled 170,000 in April, 1946, as compared with 157,500 in mid-1945 and 124,800 in mid-1939.

The oil cake and cake feed industry in Scotland has been already affected by the shortage of linseed oil, one unit, the British Oil & Cake Co., Ltd., having been forced to dispense with certain of its employees.

New D.T.D. Specifications, obtainable from H.M. Stationery Office at the prices stated, have been issued as follow: No. 423b, Aluminium Alloy Bars, Extruded Sections and Forgings (superseding D.T.D. 423a), 1s.; No. 685, Lead-Silver-Tin Solder (suitable for aircraft radiators and oil coolers), 6d.

Reports on recent investigations of pyrethrum flowers from St. Helena and patchouli oil from Nyasaland are included in the latest issue of the *Bulletin of the Imperial Institute.*

Paines & Byrne, Ltd., have taken additional factory space at Bridgend, Glamorganshire, for the manufacture of catgut. All inquiries should be addressed to the head office at Greenford, Middlesex.

Addressing the Royal Society of Edinburgh last week, Professor James Ritchie stated that the use of sodium nitrate and superphosphate on an enclosed area of the sea in the West of Scotland resulted in increased growth of the marine plant and animal communities, with resultant improvement in the quality of fish.

In an attempt to alleviate the difficulties of the Scottish linoleum industry induced by the 20 per cent. cut in linseed oil, Councillor Peter Smith, a Kirkcaldy broker, purchased 1200 tons of sardine oil from Portugal last week, but, although he made application to the Board of Trade a month ago for an import licence, he has not yet had a reply.

All existing lists of persons specified as enemy by the Board of Trade have been revoked with effect from July 9 by S.R. and O. 1946, No. 1041. The U.S. and French Governments are taking parallel action in regard to their respective lists.

The silver jubilee of the discovery of insulin was celebrated on July 5 by a special gathering of the Diabetic Association at the Royal Institution. A tribute was paid to the late Sir Frederick Banting and to the work of his collaborator, Dr. Charles Best, who delivered an oration at the meeting.

World tin production (export) in the first quarter of 1946 is estimated at 20,000 long tons, according to the International Tin Research and Development Council. Bolivia provided 9500 tons, Nigeria 3200 tons, while about 2000 tons are stated to have been exported from Malaya. The world total is 50 per cent. of the average three-monthly production in the years 1934-38 and 32 per cent. of the similar average in 1941, when output reached its peak.

In consequence of the increase in railway rates, the prices of gas coke have been raised as follows: Northern Counties, 7d. a ton; rest of England and Wales, 10d.; Scotland, nil. In the area of the London and Counties Coke Association there will be a further increase of 10d. a ton to balance the coke levy fund. Foundry coke prices are to be increased by 1s. 3d. a ton, and other hard coke by 6d. to 1s. 3d., according to area.

An ingenious adaptation of Holmstrom's system of documentation and filing of information (*see* THE CHEMICAL AGE, 1940, *42*, 186) is described in Bulletin No. 7 of the Scottish Reconstruction Committee, by A. G. Clement and R. H. S. Robertson. A particular advantage of their system is the arrangement whereby it can be used in loose-leaf binders, instead of as a card-index. Copies of the Bulletin are obtainable (3d.) from the S.R.C., 213 West Campbell Street, Glasgow, C.2.

Foreign News

The spraying of DDT in North-Central Ceylon has resulted in a remarkable reduction of the incidence of malaria.

In Shanghai, an exporters' guild has been set up by dealers in tung oil and other Chinese export commodities.

Pig-iron production at the Volta Redonda plant, the large new Brazilian steel plant, was expected to start last month with an initial rate of output of 600 tons per day.

The United States occupation authorities in Germany have purchased Belgian superphosphate fertiliser to the amount of 15,000,000 Belgian francs for the use of German farmers.

A kaolin deposit has been discovered recently in Tanganyika, some 17 miles from Dar-es-Salaam, and production is being developed.

A new ceramics factory manufacturing glazed coloured ware has recently gone into production near Rybinsk on the Volga. Its annual capacity is 330,000 slabs.

The first section of a new Russian manganese concentration plant has been completed in the manganese district of Nikopol in the Ukraine.

The Italian department of public health has recently received plans for the layout of a penicillin plant, which is to be erected in the neighbourhood of Rome as a gift from U.N.R.R.A.

Northern Rhodesia's war output of minerals reached a value of over £76,400,000, of which copper (1,400,000 tons) accounted for £67,000,000. Current copper output runs at about 15,000 tons a month.

From India it is reported that a Government committee has recommended a seven-year plan under which production of steel in India would be raised from 1,200,000 tons a year to 2,500,000 or 3,000,000 tons.

In Tanganyika, the Uruwira area has recently been toured by the colony's new mining consultant, since prospects for the mining of lead-containing minerals are considered as promising.

To avoid a slump in the production of copper sulphate, the U.S. Office of Price Administration increased the price about 65 cents per 100 lb. to cover the 2⅜ c. per lb. increase recently made in the price of copper.

In Sierra Leone, prospecting work on the lignite deposits north of Newton is being continued, and a total of 1,000,000 tons has been proved or can be classified as probable. It is suitable for making briquettes and for gas production.

Legislation is to be introduced in Ceylon for the purpose of regulating the mining of radioactive minerals found in the island. There are scanty deposits of thorianite which are now being investigated by the Government mineralogist's department. Larger occurrences of monazite and smaller deposits of another radioactive mineral, zirkellite, are also known to exist in Ceylon.

Forthcoming Events

July 16. British Standards Institution. Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1, 3.30 p.m. Annual general meeting.

July 20. British Association for the Advancement of Science. British Medical Association, Tavistock Square, London,

W.C.1, 10.15 a.m., statutory meeting of council; 10.45 a.m., statutory meeting of general committee; 12.45 for 1 p.m. (at Claridge's Hotel, Brook Street, W.1), luncheon; 3.30 p.m., general meeting—Sir Richard Gregory, Bt., F.R.S.: "Civilisation and the Pursuit of Knowledge."

Company News

Accounts for 1944 have now been published by **British Emulsifiers, Ltd.,** showing that trading profits totalled £29,418, as compared with £31,660 for the previous 15 months. The dividend of 10 per cent. compares with 12½ per cent. previously.

British Glues and Chemicals, Ltd., are raising the ordinary dividend by 5 per cent. to 15 per cent. for the year ended April 30 last. Net profit for the year is given as £109,384, as compared with £101,725 for the previous year.

The full report of **Boots Pure Drug Co., Ltd.,** for the year ended March 31 last, shows that the trading profit for the group totalled £2,122,954, as compared with £2,012,881 for the previous year. The company's net profit was £619,459, as against £554,139, and the final dividend of 15 per cent. makes a total of 35 per cent. for the year, an increase of 2½ per cent.

Reckitt & Colman, Ltd., have issued accounts for 1945, which are in revised and consolidated form. Excluding profits of companies on the Continent, group trading profit and investment income declined from £2,898,153 for 1944 to £2,737,044 last year, owing to smaller sales in the U.K. and higher costs. Provision for net profit is reduced and net profit shows an increase from £870,488 to £967,495. The final dividend of 5 per cent. again makes 20 per cent. for the year.

At the annual meeting of the **Bleachers' Association, Ltd.,** on July 5, the chairman, Sir Alan Sykes, stated that a capital reconstruction scheme would be in the hands of stockholders within a few weeks. The proposals would deal with the six years' arrears of preference dividend and a reduction in capital which, without injustice to any class of shareholder, would put the company in a position to resume payment of ordinary dividends, provided no further deterioration of trading conditions took place. Existing capital amounts to £6,306,237 in ordinary and 5½ per cent. preference stock and £2,250,000 in 4½ per cent. debentures. No ordinary dividend has been paid since 1930. On March 31 last the company had a credit balance of £143,667.

Borax Consolidated, Ltd., announce that the £1,000,000 4½ per cent. first, and £1,500,000 4½ per cent. second debenture stocks will be repaid on Jan. 1, 1947, and May 15, 1947, at 110 per cent. and 103 per cent. respectively. The amount required will be provided by the issue of £1,500,000 out of an authorised amount of £2,000,000 new 3½ per cent. debenture stock at 101 per cent., and by issue of the unissued 200,000 deferred ordinary shares of £1, each at the price of 42s. 6d. per share. The 200,000 new deferred will be offered to the holders of the £1,300,000 deferred ordinary at 42s. 6d. per share in the proportion of two new for every £13 deferred ordinary stock held on June 28. The deferred shares will be converted into stock when fully paid up. New 3½ per cent. debenture stock to an amount of £1,500,000 is to be issued at 101 per cent. The directors have no immediate intention of issuing the balance of £500,000 new stock. The effect of the scheme will be that the company saves £60,000 gross per annum in interest charges, as against a provision for dividend on the additional deferred.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

FREERS CHEMICAL WORKS, LTD., Stroud. (M., 13/7/46.) June 4, £1000 debentures; general charge. *Nil. December 4, 1945.

ARROW PLASTICS, LTD., Thames Ditton. (M., 13/7/46.) June 11, debenture to Barclays Bank, Ltd., securing all moneys due or to become due to the bank; general charge.

G. & E. BABEY, LTD., Totton, creosote manufacturers. (M., 13/7/46.) June 11, debenture to Lloyds Bank, Ltd., securing all moneys due or to become due to the bank; general charge.

BRITISH PLASTOIDS CO., LTD., Nottingham, manufacturers of plastics, etc. (M., 13/7/46.) June 3, £3150 charge to C. R. B. Eddowes, Derby; charged on Manor House (otherwise Manor Farm), Stapleford (Notts). *£1404. August 31, 1944.

J. CASARTELLI & SON (LIVERPOOL), LTD., dealers in scientific instruments. (M., 13/7/46.) June 6, debenture to Martins Bank, Ltd., securing all moneys due or to become due to the bank: general charge. *£1500. August 5, 1943.

LIBERTY INDUSTRIAL TRUST, LTD. (formerly BEACON CHEMICAL CO., LTD.), Sittingbourne. (M., 13/7/46.) June 12, debenture to Barclays Bank, Ltd., securing all moneys due or to become due to the bank; general charge. *Nil. January 26, 1945.

BRITISH ALUMINIUM CO., LTD., London, E.C. (M., 13/7/46.) June 4, disposition by Union Bank of Scotland, with consents, granted in implement of a trust deed dated September 12, 1934; charged on certain land and buildings at Falkirk. *£3,182,330. April 12, 1946.

NORTH BRITISH ALUMINIUM CO., LTD., London, E.C. (M., 13/7/46.) June 4, dispositions by Lochaber Building Co., Ltd., and by Mrs. A. L. Whitmore or Colquhoun, with consents granted in implement of a trust deed dated September 12, 1934; respectively charged on certain properties in Inverlochy and in Lochaber. *—. March 26, 1946.

STEWART PLASTICS, LTD., Teddington. · (M., 13/7/46.) May 15, charge securing £28000 and any further sums, etc., to Cheltenham and Gloucester Building Society, £500 second mortgage to Capt. T. D. Searle, Cheltenham, and £1000 third mortgage to Mrs. M. E. Czajka, Addiscombe; all charged on 87 Gloucester Road, Croydon.

Satisfaction

ARPLEX (ENGINEERS), LTD., London, W.C., manufacturers of liquid products for the protection of glass. (M.S., 13/7/46.) Satisfactions June 17 of charge securing all moneys, etc., registered October 19, and £3000 registered December 10, 1943.

Chemical and Allied Stocks and Shares

STOCK markets have been cheerful on hopefulness regarding the American loan and the renewed strength of British Funds, although business in most sections continued moderate. Home rails were easier despite the forthcoming interim dividend decisions, and movements in the other nationalisation groups remained small and indefinite apart from a sharp rise in Cable & Wireless ordinary stock.

Imperial Chemical strengthened to 43s. 3d., it being pointed out that there is a not unattractive yield on the basis of the 8 per cent. dividend ruling in recent years. B. Laporte maintained their recent rise to 100s., Fisons were 62s. 6d., and British Drug Houses rallied to 70s. awaiting the final decision regarding the proposed capital increase. Associated Cement have been steady at 70s. on the full report, while Turner & Newall firmed up to 93s., United Molasses to 56s. 9d., and the units of the Distillers Co. to 134s. Borax Consolidated eased to 48s. 6d., and British Oxygen (102s. 6d.) failed to hold all an earlier advance, but Dunlop Rubber at 74s. were good on the success of the company's big debenture issue. Elsewhere, Boots Drug firmed up to 63s. 3d. on the increased profits and strong financial position; as previously announced, the payment for the year is raised from 32½ to 35 per cent. Goodlass Wall & Lead Industries 10s. ordinary remained steady at 31s. 6d. on further consideration of the past year's results, the latter showing that the higher dividend of 10 per cent. was earned with a margin which would have provided a further 12½ per cent.

Greeff-Chemicals Holdings 5s. shares continued to attract more attention on the recent meeting, changing hands up to 13s. 3d. Monsanto Chemicals 5½ per cent. preference have marked 24s. 6d., and Leeds Fireclay preference 18s. 1½d. Among plastics and allied shares, De La Rue were £12¼, British Xylonite £7¾, and British Industrial Plastics 2s. ordinary 8s. 9d., while O. & M. Kleeman rose further to 37s. 3d. Iron and steels showed only small movements, Guest Keen easing further to 40s. on the capital proposals, but Consett Iron 6s. 8d. shares firmed up to 8s. 7½d. as a result of the meeting. Elsewhere, Staveley were better at 45s. 9d. Textiles became firmer and were featured by a rise of 1s. 3d. to 25s. 3d. in Bleachers preference, following the official news that a capital scheme is pending; the ordinary shares were slightly higher at 14s. 3d. Calico Printers were 23s. 4½d., and Bradford Dyers 24s. 9d. Activity around 57s. 6d. continued in Courtaulds, and British Celanese were 37s., but Lansil receded to 32s. xd on the results.

Lever & Unilever moved back to 56s. 3d., and Lever N.V. to 56s. 10½d., but Amalgamated Metal rose to 21s. 6d., and Imperial Smelting to 19s. 3d., while General Refractories at 23s. 1½d. were firmer. British Glues & Chemicals 4s. ordinary rose to 15s. 3d. on the higher dividend, the preference shares also moving higher at 45s. in view of their participating payment. There was again activity in Beechams deferred around 27s., reflecting recognition of the extent the company stands to benefit when E.P.T. is abolished. Timothy Whites were 46s. 6d. Triplex Glass at 44s. eased slightly, following their recent rise. There was buying of United Glass Bottle shares at over 90s. on the possibility of a further increase in dividend now that the debentures have been redeemed. Oil shares, after receding at the end of last week, rallied on the more hopeful view of international affairs, Anglo-Iranian being £5¼, Shell 93s. 9d. and Burmah Oil 71s. 3d. Canadian Eagle Oil were better at 34s.

Prices of British Chemical Products

STEADY trading activity is reported in the London industrial chemicals market, there being little change in the demand either for home or export account. Apart from the price adjustments of chemicals derived from non-ferrous metals, quotations are unchanged at recent levels, but the undertone is distinctly strong. Among the potash and soda compounds, chlorate of soda and the bichromates are in good call against a relatively short supply, and there has been a steady flow of specifications for solid and liquid caustic soda, with values well maintained. Rather more inquiry is reported for acetic acid, boric acid, borax and formaldehyde. There has been plenty of buying interest in the coal-tar products market, with spot offers difficult to negotiate. Prices are firm in all departments.

Manchester.—The demand for textile and other industrial chemicals on the Manchester market during the past week has again been affected to some extent by the prevalence of holiday conditions in a number of districts, but otherwise trading conditions are steady and prices are firm in virtually all sections. Delivery specifications for the alkalis and other heavy chemicals are circulating freely and a fair amount of replacement business on home trade account has been reported. Shippers continue to enter the market with inquiries for a fairly wide range of products. Trade in the general run of fertilisers is seasonally quiet, but a steady business is being done in the leading tar products, both light and heavy.

Glasgow.—Little change can be recorded for conditions in the Scottish heavy chemical market during the past week. A large number of price alterations has taken place owing to the increase in rail rates which took effect at the beginning of July, and all classes of chemicals have been affected. Inquiries and orders are still far in advance of supplies, and there is no sign that supplies will meet the demand for a considerable time. Export inquiries for zinc oxide, formaldehyde, sulphur, and sodium hydrosulphite have been very brisk, and a considerable volume of business has been done.

Price Changes

Rises: Coconut oil; copper sulphate; lead, red; lead, white; palm kernel oil; sodium nitrate; zinc oxide.

Falls: Ammonium phosphate; ammonium sulphate; pitch (Manchester).

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton, £47 10s.; 80% pure, 1 ton, £49 10s.; commercial glacial, 1 ton, £59; delivered buyers' premises in returnable barrels, £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r. Manchester: £16 to £16 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. Manchester: £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—Manchester: £39 10s. per ton d/d.

Ammonium Carbonate.—£37 10s. to £38 per ton d/d in 5 cwt. casks. Manchester: Powder, £43 d/d.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £19 10s. per ton. See also Salammoniac.

Ammonium Persulphate.—Manchester: £5 per cwt. d/d.

Antimony Oxide.—£110 to £117 per ton.

Arsenic.—Per ton, 99/100%, £28 10s. for 20-ton lots, £31 for 2 to 10-ton lots; 98/99%, £25 for 20-ton lots, £29 10s. for 2 to 10-ton lots; 96/99% white, £21 15s. for 20-ton lots, £25 15s. for 2 to 10-ton lots.

Barium Carbonate.—Precip., 4-ton lots, £19 per ton d/d; 2-ton lots, £19 5s. per ton. bag packing, ex works.

Barium Chloride.—98/100% prime white crystals, 4-ton lots, £19 10s. per ton, bag packing, ex works.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £18 15s. per ton d/d; 2-ton lots, £19 10s. per ton.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax.—Per ton for ton lots, in free 1-cwt. bags, carriage paid: Commercial, granulated, £30; crystals, £31; powdered, £31 10s.; extra fine powder, £32 10s.

B.P., crystals, £39; powdered, £39 10s.; extra fine, £40 10s. Borax glass, per ton in free 1-cwt. waterproof paper-lined bags, for home trade only, carriage paid: lump, £77; powdered, £78.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granulated, £52; crystals, £53; powdered, £54; extra fine powder, £56. B.P., crystals, £61; powder, £62; extra fine, £64.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£22 to £24 per ton, ex wharf. Granulated, supplies scarce.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5⅝d. per lb.

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Carbonate.—MANCHESTER: £8 5s. per cwt. d/d.

Copper Oxide.—Black, powdered, about 1s. 4½d. per lb.

Copper Sulphate.—£33 10s. per ton, f.o.b., less 2%, in 2 cwt. bags.

Cream of Tartar.—100 per cent., per cwt., from £13 17s. 6d. for 10-cwt. lots to £14 1s. per cwt. lots, d/d. Less than 1 cwt., 2s. 5½d. to 2s. 7½d. per lb. d/d.

Formaldehyde.—£27 to £28 10s. per ton in casks, according to quantity, d/d. MANCHESTER: £28.

Formic Acid.—85%, £54 per ton for ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1260 s.g., in tins, £4 to £5 per cwt., according to quantity; in drums, £3 19s. 6d. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—11d. per lb. d/d, carboys extra and returnable.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d. per lb., according to quantity.

Lactic Acid.—Pale tech., £60 per ton; dark tech., £53 per ton ex works; barrels returnable.

Lead Acetate.—White, 57s. to 60s. per cwt., according to quantity.

Lead Nitrate.—About £53 per ton d/d in casks. MANCHESTER: £53 10s.

Lead, Red.—Basic prices per ton: Genuine dry red lead, £71; orange lead, £83. Ground in oil: Red, £84; orange, £95. Ready-mixed lead paint: Red, £86; orange, £98.

Lead, White.—Dry English, in 8-cwt. casks, £83 per ton. Ground in oil, English, in 5-cwt. casks, £94 10s. per ton.

Litharge.—£57 10s. to £60 per ton, according to quantity.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £36 per ton.

Magnesium Chloride—Solid (ex wharf), £22 per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., for 2-cwt lots. 9s. 1d.; smaller quantities dearer.

Mercurous Chloride.—10s. 1d. to 10s. 7d. per lb., according to quantity

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 3s. per gal.; pyridinised 64° O.P. 100 gal., 3s. 1d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works

Oxalic Acid.—62s. 6d. to 65s. per cwt. £85 5s. per ton in ton lots, packed in free 5-cwt. casks. MANCHESTER: £4 to £4 2s. 6d. per cwt.

Paraffin Wax.—Nominal.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £76 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate. — Crystals and granular, 7¾d. per lb.; ground, 8¼d. per lb., for not less than 6 cwt.; 1-cwt. lots, ¼d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £57 per ton for 5-ton lots, £57 10s. per ton for 1 to 5-ton lots, all ex store; hydrated, £51 per ton for 5-ton lots, £51 10s. for 1 to 5-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 8½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8d. per lb.; technical, £7 14s. 3d. to £8 6s. 3d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Salicylic Acid.—MANCHESTER: 1s. 8d. to 2s. 1d. per lb. d/d.

Soda, Caustic.—Solid 76/77%; spot, £16 7s. 6d. per ton d/d.

Sodium Acetate.—£42 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 6½d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite.—Powder, 60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£36 to £45 per ton, nominal.

Sodium Hyposulphite.—Pea crystals 19s. per cwt. (ton lots); commercial, 1-ton lots, £17 per ton carriage paid. Packing free.

Sodium Iodide.—B.P., for not less than 28 lb., 9s. 11d. per lb., for not less than 7 lb., 13s. 1d. per lb.

Sodium Metaphosphate (Calgon).—11d. per lb. d/d.

Sodium Metasilicate.—£16 10s. per ton, d/d U.K. in ton lots.

Sodium Nitrite.—£22 10s. per ton.

Sodium Percarbonate.—12½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £25 per ton d/d for ton lots. Tri-sodium, £27 10s. per ton d/d for ton lots (crystalline).

Sodium Prussiate.—9d. to 9½d. per lb. ex store

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salt).—£4 10s. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. MANCHESTER: £4 12s. 6d. to £4 15s. per ton d/d station.

Sodium Sulphide.—Solid, 60/62%, spot, £19 2s. 6d. per ton, d/d, in drums; crystals, 30/32%, £12 7s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £20 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £14 to £16 5s., according to fineness.

Sulphuric Acid.—168° Tw., £6 2s. 8d. to £7 2s. 8d. per ton; 140° Tw., arsenic-free, £4 11s. per ton; 140° Tw., arsenious, £4 3s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—Per cwt., for 10 cwt. or more, £15 8s.; 5 to 10 cwt., £15 9s. 6d; 2 to 5 cwt., £15 11s.; 1 to 2 cwt, £15 13s. Less than 1 cwt., 3s. 1d. to 3s. 3d. per lb. d/d, according to quantity.

Tin Oxide.—Nominal.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d; white seal, £54 5s.; green seal, £53 5s.; red seal, £51 15s.

Zinc Sulphate.—Tech, £25 per ton, carriage paid.

Rubber Chemicals

Antimony Sulphide.—Golden, 1s. 5d. to 2s. 6d. per lb. Crimson, 2s. 2d. to 2s. 6d. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 8s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£37 to £41 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£44 to £49 per ton according to quantity.

Chromium Oxide.—Green, 2s ped lb.

India-rubber Substitutes.—White, 6 3/16d to 10½d. per lb.; dark, 6 3/16d. to 6 15/16d. per lb.

Lithopone.—30%, £26 5s. per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Plus 5% War Charge.

Nitrogen Fertilisers

Ammonium Phosphate.—Imported material, 11% nitrogen, 48% phosphoric acid, per ton in 6-ton lots, d/d farmer's nearest station, in July, £19 7s., rising by 5s. per ton per month to September, then by 2s. 6d. per ton per month to March, 1947.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, in July, £9 11s., rising by 1s. 6d. per ton per month to March, 1947.

Calcium Cyanamide.—Nominal; supplies very scanty.

Concentrated Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. No. 1 grade, where available, £14 18s. 6d.

"Nitro Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £17 5s. per ton; granulated, over 98%, £16 per ton.

Coal Tar Products

Benzol.—Per gal. ex works: 90's, 2s. 6d.; pure, 2s. 8½d.; nitration grade, 2s. 10½d.

Carbolic Acid.—Crystals, 11½d. per lb. Crude, 60's, 4s. 3d. MANCHESTER: Crystals, 9¼d. to 11½d per lb., d/d; crude, 4s. 3d., naked, at works.

Creosote.—Home trade, 5⅞d. to 8d. per gal., according to quality, f.o.r. maker's works. MANCHESTER, 6½d. to 9¾d. per gal.

Cresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. MANCHESTER: Pale, 99/100%, 4s. 4d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices

Naphthalene.—Crude, ton lots, in sellers' bags, £7 2s. 6d. to £10 per ton, according to m.p.; hot-pressed, £11 10s. to £12 10s. per ton, in bulk ex works; purified crystals, £25 15s. to £28 15s per ton. Controlled prices.

Pitch.—Medium, soft, home trade, 75s. per ton f.o.r. suppliers' works; export trade, 120s. per ton f.o.b. suppliers' port. MANCHESTER: 75s. to 77s. 6d. f.o.r.

Pyridine.—90/140°, 18s. per gal.; 90/160°, 14s. MANCHESTER: 14s. 6d. to 18s. 6d. per gal.

Toluol.—Pure, 3s. 1d. per gal.; 90's, 2s. 4d. per gal. MANCHESTER: Pure, 3s. 1d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 3½d. to 3s. 6d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £21 per ton; grey, £24. MANCHESTER: Grey, £24 to £25 per ton.

Methyl Acetone.—40/50%, £56 per ton.

Wood Creosote.—Unrefined, about 2s. per gal., according to boiling range.

Wood Naphtha, Miscible.—4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. per gal.

Wood Tar.—£5 per ton.

Intermediates and Dyes (Prices Nominal)

m-**Cresol** 98/100%.—Nominal.

o-**Cresol** 30/31° C.—Nominal.

p-**Cresol** 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb; 66/68° C., 1s.

p-**Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

o-**Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

p-**Toluidine.**—2s. 2d. per lb., in casks.

m-**Xylidine Acetate.**—4s. 5d. per lb., 100%

Latest Oil Prices

LONDON.—July 10.—For the period ending August 3 (August 17 for refined oils), per ton, naked, ex mill, works or refinery, and subject to additional charges according to package: LINSEED OIL, crude, £65. RAPESEED OIL, crude, £91. COTTONSEED OIL, crude, £52 2s. 6d.; washed, £55 5s.; refined edible, £57; refined deodorised, £58. COCONUT OIL, crude, £49; refined deodorised £56; refined hardened deodorised, £60. PALM KERNEL OIL, crude, £48 10s.; refined deodorised, £56; refined hardened deodorised, £60. PALM OIL (per ton c.i.f.), in returnable casks, £42 5s.; in drums on loan, £41 15s.; in bulk £40 15s. GROUNDNUT OIL, crude, £56 10s.; refined deodorised, £58; refined hardened deodorised, £62. WHALE OIL, crude hardened, 42 deg., £84; refined hardened, 46/48 deg., £85. ACID OILS: Groundnut, £40; soya, £38; coconut and palm-kernel, £43 10s. ROSIN: Wood, 32s. to 45s.; gum, 44s. to 54s. per cwt., ex store, according to grade. TURPENTINE, American, 87s per cwt. in drums or barrels, as imported (controlled price).

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Esters.—E. Lilly & Co. 17221-2.

Cutting of plastic material.—N. S. McNab. 17300.

Metal powder melting.—O. J. Metzger. 16993.

Cathode-ray tubes.—R. Milne, and D. McMullen. 17137.

Zinc.—National Smelting Co., Ltd., and L. J. Derham. 17052.

Zinc.—National Smelting Co., Ltd., and S. Robson. 17053.

Alloys.—Paramount Alloys, Ltd., and H. J. Henbrey. 17239.

Cathode-ray tubes.—F. N. Scaife, E. Parker, H. Jackson, and C. S. Wright. 17279.

Organic compounds.—P. F. C. Sowter, and W. A. Rogerson. 17075.

Granulation of molten chemicals.—Spolek Pro Chemickou a Hutni Vyrobu, Narodni Podnik. 17026.

Fibrous materials.—A. H. Stevens. (Monsanto Chemical Co.) 16902.

Acid pickling baths.—N. Swindin. 17212.

Dehydrochloric acid.—A. Abbey. (Armour & Co.) 17987.

Hydrocarbons.—Anglo-Iranian Oil Co., Ltd., S. F. Birch, and J. Habeshaw. 17643.

Acetal decomposition.—C. Arnold. (Standard Oil Development Co.) 17571.

Hydrocarbons.—J. C. Arnold. (Standard Oil Development Co.) 17506.

Carbon monoxide.—J. C. Arnold. (Standard Oil Development Co.) 17507.

Baking ceramic products.—L. Bernardaud et Cie. 17497.

Aromatic amines.—S. F. Birch, F. A. Fidler, D. V. N. Hardy, and E. L. Molloy. 17719.

Insect detergents.—R. G. Boniface. 17544.

Amidines.—Boots Pure Drug Co., Ltd., P. Oxley, and W. F. Short. 17636.

Heating liquid baths.—M. Boss. 18125.

Aluminium base alloy.—T. F. Bradbury. 17720.

Organic acids.—J. G. M. Bremner, D. G. Jones, and I.C.I., Ltd. 17413.

Organic compounds.—J. G. M. Bremner, F. Starkey, D. A. Dowden, and I.C.I Ltd. 17414.

Elastomers.—British Thomson-Houston Co., Ltd. 17374, 17375.

Chlorosilanes.—British Thomson-Houston Co., Ltd. 17376.

Hydrocarbon compositions. — British Thomson-Houston Co. 18139.

Measuring instruments.—R. O. Browning. 17406.

Liquid filtration.—R. S. Brownlow. 17638.

Mixing apparatus.—B. Brunton, H. Rose, and T. E. Carron. 17516.

Glutamic acid.—A. F. Burgess. (International Minerals & Chemical Corporation.) 17624.

Fungicide dispersing.—R. D. Campbell, J. D. Campbell, and H. Campbell. 17886.

Dyestuffs.—Ciba, Ltd. 17605.

Solder analysers.—Continental Can Co., Inc. 17655.

Treatment of textile fibres.—A. K. Croad. (Alrose Chemical Co.) 17802.

Heat treatment of alloy steels.—E. T. Digby. 18073.

Oxygen jet cutting nozzles.—C. Dod. 18106.

Liquid atomisers.—Drugs, Ltd. (S. Gimelli.) 17631.

Pipe connections.—E. Duffield, and Yorkshire Copper Works, Ltd. 17937.

Thermoplastics.—Dunlop Rubber Co., Ltd., R. A. Canter, and T. E. H. Gray. 18057.

Centrifugal sprayer.—D. Dunnet. 17858.

Thermosetting compositions.—E. I. Du Pont de Nemours & Co. 17919.

7-Dehydro-cholesterol.—E.I. Du Pont de Nemours & Co., and J. A. Callan. 17920.

Tube connectors.—H. Eisner. 17656.

Iron base alloys.—Eléctro Metallurgical Co. 17851.

Iron base alloys.—Electro Metallurgical Co. (Cognate with 17851.) 17852.

Ferrous alloys.—Electro Metallurgical Co. 17853-4.

Drying of flowable solids.—J. L. Erisman. 17801.

Complete Specifications Open to Public Inspection

3.4-Di-(*p*-hydroxy-phenyl)-hexadiene-2.4.—F. Hoffman-La Roche & Co. A.G. Dec. 5, 1944. 23317/45.

Vinyl esters and polymers and interpolymers derived therefrom.—I.C.I., Ltd. Dec. 9, 1944. 33334/45.

Insolubilisation of polyamides.—I.C.I., Ltd. Dec. 8, 1944. 33336/45.

Production of fluorinated hydrocarbons.—I.C.I., Ltd. Dec. 8, 1944. 33337/45.

Handling liquids.—Josam Manufacturing Co. Dec. 6, 1944. 31685/45.

Basic calcium chlorate.—Solvay & Cie. Dec. 5, 1944. 30668/45.

Preparation of diarylamines.—Timbrol, Ltd. Dec. 11, 1944. 31040/45.

Liquid sprayers.—E. W. Vose. Dec. 7, 1944. 9055/44.

Alkali aluminium fluoride.—A/S Norsk Aluminium Co. Feb. 11, 1941. (Cognate applications 13186-7-8/46.) 13185/46.

Cryolite.—A/S Norsk Aluminium Co. May 6, 1941. (Cognate applications 13190-13191 46.) 13189/46.

Heat-resisting alloys.—Allegheny Ludlum Steel Corporation. Jan. 23, 1943. 6046/44.

Halogeno-hydrocarbon polymers.—American Viscose Corporation. July 14, 1943. 9246/44.

Thermostatically adjustable fluid circulator means.—G. Annesley. Dec. 14, 1944. 33812/45.

Modification of fatty oils or derivatives thereof.—Bakelite, Ltd. Dec. 14, 1944. 31965 45.

Abrasives.—Cie. de Produits Chimiques et Electrometallurgiques Alais, Froges & Camargue. Dec. 12, 1944. 33479/45.

Fluid pressure energy translating devices. —Denison Engineering Co. Dec. 14, 1944. 26631/45.

Preparation of filtered infusions.—J. Derek. Dec. 14, 1944. 33787/45.

Chemical products.—E.I. Du Pont de Nemours & Co. Sept. 18, 1943. 23160/44.

Production of aminoacetonitrile.—E.I. Du Pont de Nemours & Co. Aug. 22, 1944. 21439/45.

Compositions comprising acrylonitrile polymers and copolymers and shaped articles produced therefrom.—E.I. Du Pont de Nemours & Co. Dec. 14, 1944. 33894/45.

Organic chemicals.—E.I. Du Pont de Nemours & Co. Dec. 14, 1944. 33895/45.

Saturated alpha, omega-dinitriles.—E.I. Du Pont de Nemours & Co. Dec. 14, 1944. 33896/45.

Condensation products from 1 : 8-naphthosulphone, and the resulting products.—J. R. Geigy A.G. Dec. 12, 1944. 34222/45.

Mixing Apparatus.—Girdler Corporation. Sept. 14, 1943. 18618/44.

Press moulded articles made of ceramic masses.—S. F. Glauberg. April 6, 1944. 10641/46.

Hollow electrodes for salt bath furnaces. —A. de F. Holden. Dec. 13, 1944. 27501/45.

Elastomeric materials.—Imperial Chemical Industries, Ltd. Nov. 16, 1944. 30441/45.

Apparatus for the determination of the flash-point of a substance.—E. Jenson. Nov. 9, 1944. 13280/46.

Azeotropic distillation.—Lummus Co. Feb. 9, 1942. (Cognate applications 2183-2184 43.) 2182 43.

Electrolytically separating zinc from a bath containing zinc cyanide.—N.V. Philips Gloeilampenfabrieken. Dec. 24, 1941. 12972/46.

Fire extinguishing foam.—National Foam System, Inc. March 12, 1943. 4227/44.

Checking butyric acid fermentation in cheese and other preserves.—T. Nielsen. Sept. 18, 1941. 24409/45.

Complete Specifications Accepted

Manufacture of coating compositions.—H. Sohm. Dec. 19, 1941. 577,954.

Process for the alkylation of iso-paraffins with olefins.—Standard Oil Development Co. Feb. 12, 1942. 577,869.

Lubricating oil compositions by the addition of compounds having oxidation-inhibiting and like qualities.—Standard Oil Development Co. Jan. 1, 1942. 577,955.

Process and apparatus for the cracking of carbonaceous material.—M. Steinschlaeger. March 21, 1944. 577,906.

Manufacture of composite metal articles. —W. O. Alexander, and I.C.I., Ltd. April 28, 1943. 577,986.

Heat exchange devices.—W. O. Alexander, C. S. Steadman, and I.C.I., Ltd. July 5, 1944. 578,003.

Production of nitroparaffins.—M. P. Appleby, and I.C.I., Ltd. April 23, 1943. 578,044.

Curing or vulcanisation of chloroprene-type synthetic rubber-like materials.—W. Baird, B. J. Habgood, D. A. Harper, J. A. Hendry, and I.C.I., Ltd. March 11, 1943. 578,012.

Production of α-chloracrolein.—J. G. M. Bremner, D. G. Jones, and I.C.I., Ltd. July 19, 1944. 578,071.

Manufacture of metalliferous materials for use as catalysts.—H. E. Charlton. Sept. 22, 1941. 577,974.

Heat exchange devices.—J. L. Coltman, and I.C.I., Ltd. Jan. 19, 1943. 577,979.

Explosive compositions.—F. Dawson. E. Fajans, J. L. Moilliet, and I.C.I., Ltd. March 22, 1943. 578,081.

Surgical and dental alloys.—Deloro Smelting & Refining Co. June 1, 1943. 578,097.

Manufacture of organic compounds containing sulphur.—E.I. Du Pont de Nemours & Co., and A. M. Alvarado. May 26, 1943. 578,124.

Electrodeposition of tin.—E.I. Du Pont de Nemours & Co., and N. F. Blackburn. July 13, 1944. 578,069.

Cellulose derivatives.—E.I. Du Pont de Nemours & Co., H. F. Mark, and S. Siggia. June 23, 1944. 578,067.

Hot cathode mercury vapour rectifying apparatus.—Electric Furnace Co., Ltd., and S. G. King. May 22, 1944. 578,137.

Crystal contacts of which one element is silicon.—General Electric Co., Ltd., and C. E. Ransley. March 22, 1943. 578,013.

Manufacture of silicon material for crystal contacts.—General Electric Co., Ltd., C. E. Ransley, J. W. Ryde, and S. V. Williams. July 19, 1941. (Cognate applications 16431/41 and 12969/42.) 577,976.

Crystal contacts of which one element is silicon.—General Electric Co., Ltd., C. E. Ransley, J. W. Ryde, and S. V. Williams. July 18, 1941. 578,116.

Manufacture of butadiene.—G. M. Henderson, and I.C.I., Ltd April 30, 1943 578,086.

Manufacture of sulphathiazole derivatives.—Herts Pharmaceuticals, Ltd., C W. Picard, D. E. Seymour, and F. E. Smith. Aug. 4, 1944. 578,004.

Manufacture of polymerisable products from hydrogenated naphthalene and of resins made therefrom.—W. I. Jones, Powell Duffryn, Ltd., and R. Hutt. April 16, 1943. (Cognate applications 6143/43 and 9162/44.) 578,083.

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The Chemical Age

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV
No. 1412. — July 20, 1946 — Annual Subscription 21s. Overseas 26s.

A Five-Day Week

THE problem of the five-day week in industry is becoming acute in view of the greater insistence on shorter working hours. Throughout the industrial revolution there has been a progressive improvement in working conditions. It was perhaps natural that the earliest factories should be designed for production without consideration of the amenities of life. Most of the employees were totally uneducated, unable even to read or write. It is thus hardly surprising that as Adam exchanged his delving as an agricultural worker to join Eve in her spinning—and in many more arduous industrial pursuits—there should be left no gentlemen to agitate in favour of improved working conditions. There is little doubt that the spread of education was responsible for arousing a feeling of unwillingness to work under slum conditions. Hours of work were progressively decreased; not only Sunday but Saturday afternoon also became a period of rest and relaxation, and as people found more pursuits to occupy their leisure time and became better equipped to occupy it profitably they began to demand not only shorter hours but better conditions at work.

It was pointed out during the difficult years following the First World War that the increasing use of machinery and the inventions of the age had made it possible for the machine to do much of the work that had formerly to be done painfully by manual labour. We looked forward to a time when the machine would so far replace purely manual work that working hours could be reduced drastically indeed and a longer period of retirement could be given to those who were desirous of some leisure at the end of their lives. The late war has altered this conception quite a lot because we have lost the money on which we could have retired and we are compelled as a nation to work for our living harder than for many a generation. For the time being, therefore, our dreams of a very short working week and a short working life must be set aside. The call is for production and still more production, and we doubt whether our generation will secure anything like the amount of leisure that will be possible in a world at peace to those who live 50 or 100 years hence. Fundamentally, the position has not changed. The machine is still with us and its productivity has been increased as a result of the war. All that has happened has been that the golden age of leisure has been set farther ahead in time than it appeared likely to be 20 years ago. This, however, is

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only a setback of a temporary character. We have to remember also that a great part of the world is as yet undeveloped or under-developed. Politically and economically the time has not yet come to rest on our achievements.

We may also note that a century or two hence, when man is really ready to return to the Garden of Eden because he has settled his political problems, secured universal peace, and brought the whole world to a high standard of living, the power to live in his Garden of Eden may have passed from him. That power is dependent on possessing the necessary resources with which to operate his machinery. At present the world has ample supplies of coal. We know that atomic energy as now envisaged, based on uranium, will be exhausted before the world's coal supplies. We have yet to discover a source of energy that will effectively and indefinitely take the place of coal. It may well be, therefore, that the serpent will again be responsible for driving man from his haven of leisure and that this serpent will take the form of shortage of fuel and power.

That is looking a long way ahead, and in the meantime it is necessary for us to come down to earth. We have indicated that for our generation, whatever is done to improve the conditions of work or to reduce working hours, it should always be remembered that the first principle must be to maintain productivity. "In the sweat of thy brow shalt thou eat bread," is the law of life which is inexorable and which has never applied more forcibly than it does to-day. What, then, can be done?

The mining industry might be taken as an example. It is unfortunate that the miners exercise a good deal of political power and that the Government depends so greatly upon them for support. In some respects that fact prevents the mining industry from being considered on its merits. The recent Conference of the National Union of Mine Workers produced an amazing amount of soft soap which was duly spread all over the miners by members of the Government. Disregarding soft soap, however, let us face the fact that the coal output has gone down in a striking manner during the last few years; and this applies not only to the total coal output but to the output per man-shift. The result is that this country is facing next winter the most serious fuel position that it has ever faced—more serious than at any time during the war. The possibility of drastic cuts in electricity and gas supply is already evident. The probability that works will be required to go slow or even to close down for periods on account of fuel shortage already looms ahead. It is a significant fact that the rate of absenteeism at the pits has increased progressively from 6.9 per cent. in 1939 to 10.4 per cent. in 1942, 13.6 per cent. in 1944, 16.3 per cent. in 1945, and over 18 per cent. in the first quarter of 1946. Moreover the output per man-shift while at work has decreased from an average of over 60 cwt. in 1939 to 54 cwt. in 1945. It has been stated that these comparisons mean that if last year the output per unit of capital and labour employed had been as good as in 1941, then with the number of wage-earners now on the colliery books the output would be 210 million tons a year now instead of the present figure of 172 million tons. It is also true that whereas other countries increased their working hours when war broke out, in Britain the miner continued to spend 7½ hours per shift underground and the working week of less than six days remained unchanged.

Mr. Shinwell has now promised the miners the introduction of a five-day week. If it is true that the miners are tired—as are other sections of the nation—after the war, that they are older, and that they need more leisure, we cannot doubt that two consecutive days of leisure each week should enable them to obtain the necessary rest and relaxation so that they will be prepared to work for the remaining five days with an output equal to that of 1939 and with an absenteeism figure similar to that of the same year. It is an interesting experiment and one which many feel has demanded a good deal of courage on the part of the Minister of Fuel. Quite frankly, if we had been in his shoes we should have been very much disposed to do what he has done. But we shall await the outcome of this experiment with considerable interest because it will set a standard for productive enterprise all over the country. We have had the five-day week at The Chemical Age offices for many years now and we have found that we can get our work done in five days just as efficiently as in 5½. But that principle may not necessarily apply to factories and works where production is primarily a matter of machinery rather than of personal effort.

NOTES AND COMMENTS

Newton's Tercentenary

DURING the week just past, the Royal Society has been commemorating the tercentenary of the greatest scientist the world has ever known—Sir Isaac Newton. The actual date fell in 1942, when conditions were hardly suitable for an international celebration, but the function has lost nothing by the four years' delay. On Monday, some 140 delegates from various scientific academies met at Burlington House to hear Sir Robert Robinson, P.R.S., announce that the proposal to establish a fitting national memorial in the form of an Isaac Newton Observatory had been recently forwarded to the Treasury, and that the scheme to erect a 100-in. telescope had been accepted in principle by the Chancellor of the Exchequer. Delegates also heard Professor Andrade's lecture on the life and achievements of Newton, in which he recorded that, at the age of 29, the sage had accomplished "a body of scientific work such as no one before or since had done at that age." Speaking of Newton's work in chemistry, Professor Andrade speculated on the hidden meaning behind Newton's words on the transmutation of metals. Two passages in the famous letters on that subject seem to indicate more than a warning against the conversion of base metals into gold, and, in view of recent events, are indeed remarkable. As Professor Andrade said, Newton seems to have derived his knowledge from "something more like a direct contact with the unknown sources that surround us . . . than has been vouchsafed to any other man of science." At the conversazione at Burlington House, on Tuesday, delegates had the opportunity of examining the Royal Society's unique collection of Newton relics.

Co-ordination of Empire Research

THE Empire Scientific Conference held its final session on Monday last week. A large number of recommendations were agreed, covering a wide range of scientific subjects of importance to the Empire. These have been forwarded to the Official Scientific Conference, whose task it is to consider means of implementing them, bearing in mind shortage of manpower, buildings and, in some cases, of money. It is too early to say whether the Empire Conference has been a success; but if only 10 per cent. of the recommendations are put into effect the Conference can be considered a success. It will, however, probably be after ten or fifteen years, when the Conference can be seen in its proper perspective, that its results can be properly assessed. At the very least it can be said that the Conference will exert a beneficial influence on the progress of scientific co-operation in the Empire and on the intensification of scientific effort. Perhaps the most fruitful result will be the experience gained by delegates of what is being done in the other Empire countries. The recommendations include a considerable number of generalities, but there are also a number of specific proposals on which action could, and should, be taken. In addition, it was recommended that a standing central committee be set up to advise on policy for the co-ordination of research into the natural products of the Commonwealth. What this amounts to is co-operation of the Dominions with the Colonial Products Research Council. During the conference the inter-relation between research on diseases in the tropics, nutritional science and land conservation was clearly brought out. The last of these is the basic factor, and unless this problem is effectively solved, any benefits from the prevention of tropical diseases will be nullified by inability to feed the increases in population.

B.A.C. and T.U.C

A DECISION on the question of affiliation to the Trade Union Congress is to be asked for by a general ballot from the members of the British Association of Chemists. The question is dispassionately reviewed in an editorial article in the current issue of the *Journal of the B.A.C.*, following a discussion held at an extraordinary general meeting last month. Mr. David Jackson, the new chairman of the London section, adduced arguments in favour of affiliation, basing his claim on the tendency of Governments to-day, irrespective of party, to look to collective bodies before taking action on any given subject. The opposition took its stand on the essential impartiality of the chemist's position, and gave their opinion that any assistance which chemists might require would be best obtained through the offices of a non-

political organisation. They also brought up the difficulty involving the large (and, we believe, increasing) number of senior chemists holding positions on boards of directors. Editorially, the *Journal of the B.A.C.* holds that the real question of the moment is to get the very numerous unattached chemists affiliated to *some* association, and that the T.U.C. matter takes a secondary place. However, the question is to be put to the vote, and we heartily concur with the suggestion that all entitled should record a vote one way or the other; and with the hope expressed that each individual chemist, if the decision taken does not happen to coincide with his particular views, should not forthwith resign in a huff. Chemists are not particularly vocal people, as a class; it might help the profession if they were a little more ready to express their views through the medium of their Press.

Micro-Manipulation

A DEMONSTRATION of the amazing advances that have been made in the practice of cinemicrography was provided at the theatre of the Films Department of the British Council last Monday, when Monsieur de Fonbrune, of the Department of Cinemicrography, Institut Pasteur, Garches, near Paris, showed some of the films that his department has been producing during the last few years. Experimental work was started by Dr. Comandon and M. de Fonbrune in 1908, and recent results have achieved something near perfection. The majority of the films exhibited were largely of biological interest, and they have, indeed, helped to solve many biological problems; but one series was of more general appeal, namely, that which demonstrated the technique of micromanipulation, with its possible application to problems of biochemistry, and indeed to microchemistry generally. The extremely fine tools—micropipettes, needles, hooks, etc.—needed for microbiological work are made under direct microscopic observation with an apparatus known as a "microforge," in which the requisite heat is applied to the glass under treatment by means of a tiny platinum rod heated to incandescence. In general, the glass used is of the Pyrex type, though soft glass may be used for special purposes. The film showed in detail the methods used in the manufacture of several kinds of instrument; and for handling these instruments a special type of micro-manipulator has been devised, allowing extremely delicate control of their movement. A striking proof of the effectiveness of the method was given by the actual production on the film of life-sized drawings of microbes; the circle within which they were drawn was 10μ in diameter and was afterwards shown comfortably superimposed on a photomicrograph of a fly's leg!

Plastics: a Warning

SOME indication of the extent to which the plastics industry is expanding is to be found in the frequency with which particulars of new plastics companies appear in the columns of this journal. The remarkable developments that have taken place in plastics recently were commented upon the other day by Sir John Anderson when speaking at a luncheon of the London district section of the Institute of the Plastics Industry. He pointed out that a tremendous field lay before them in articles not necessarily used in industry, such as attractive fabrics, but he went on to utter a warning against expecting too much from plastics. Although he agreed the industry was capable of vast development, he considered it would be a mistake to make exaggerated claims for its products, which would not, to any great extent, replace such familiar products as timber, metal, stone, or concrete. Speaking of the scarcity of trained scientists and technicians in this country, Sir John said he was glad to learn that the Institute contemplated providing scholarships on a large scale to encourage young men and women to undertake technical training.

Iron and Steel Output

Increases During Second Quarter

ACCORDING to the Ministry of Supply, the production of pig-iron, and of steel ingots and castings, in the U.K. during the second quarter of this year, both showed increases over the figures for the first quarter Comparisons are shown in the table below, all the figures given representing tons:

	Weekly average	Annual rate
PIG IRON		
First quarter ...	145,500	7,566,000
Second quarter ...	150,500	7,827,000
June	151,500	7,878,000
STEEL INGOTS AND CASTINGS		
First quarter ...	242,600	12,617,000
Second quarter ...	252,100	13,111,000
June	239,900	12,475,000

Phosphating Metallic Surfaces

III—Finishing Treatment

by W. G. CASS

(*Continued from* THE CHEMICAL AGE, *July* 13, 1946, *p.* 38)

FINISHING operations after phosphating comprise immediate rinsing and/or sealing, followed by oiling, greasing, painting, varnishing, enamelling, electroplating, or a combination of two or more of these. Thorough rinsing after phosphating is of considerable importance, especially if at the same time a pore-sealing effect is achieved, *e.g.*, by addition of chromic acid or chromate in the rinse-water; for thus also the surface is better prepared for the real finishing treatment by painting, etc.

In some of their early phosphating baths of the copper type the Parker Company proposed subsequent rinsing or treatment in a hot solution of chromate or in a 2 per cent. alkali cyanide solution in order to fix the copper in a more rust-resistant form. *See* also W. H. Allen's U.S.P. 1,260,740. In Parker's B.P. 362,746 phosphate-coated iron or steel containing copper in the coating is treated with a hot chromic acid solution, or with potassium chromate. It is stated that the copper does not directly improve the rust-proofing properties but prepares the surface better for paint. In B.P. 517,049 of the Pyrene Company, in which it is claimed that phosphating can be done in about a minute by spraying, a chromate or oxalic or other rinse is used; as also in Parker's B.P. 551,261, 552,569, 557,846 (stated that chrome rinsing may affect paint adherence). In some cases a non-chromic hot water rinse is recommended. Chromic acid or chromates, of course, figure prominently in various coating processes, with or without phosphating, more particularly for the light metals and alloys.

Thorough Drying Essential

Thorough drying after rinsing is also necessary, and fairly high temperatures may be used, *e.g.*, up to 250° C. or more, for the phosphate coatings are stable at much higher temperatures than this (J. Moshage, *Practical Rust-proofing*, 1934, 73). The Metallges. A.G. proposes, for washing, the addition of small amounts (4-7 g./100 l.) of acid chromate or chromic acid (G.P. 690,447); and also, before varnishing, the sealing of the pores with aluminium oxide (G.P. 597,365), *e.g.*, by treating the phosphated parts with solutions of hydrolytic aluminium salts. The Patents Corporation or Metal Finishing Research Corp. propose after-treatment with dilute chromic, phosphoric, or oxalic acid solution, or with solutions of ferrous, aluminium, or chromium salts, especially nitrates (U.S.P. 2,067,214-6). For rinsing, etc., the Curtin-Howe Corp. (U.S.P. 2,120,212) uses weak alkaline solutions with partial conversion into basic phosphate, comprising, *e.g.*, hydroxide, carbonate, cyanide, sodium aluminate, and basic lead acetate.

For colouring phosphated articles Borodulin and Nemtschinowa (Russ.P. 40,480) propose an aqueous solution containing tannin, iron sulphate, and dextrin, followed by immersion in a chromate solution. A parkerised coating which would not normally be lacquered or otherwise coloured may, however, be easily stained by immersion in a warm dilute solution of dye or stain, dried, and finally sealed. Just recently Parkers have introduced an improved colour-phosphating method which does not apparently require this subsequent staining. The colours are grey, blue, purple, and green. A colour process incorporating a stannous salt together with a dye which is claimed to enhance protective quality of coating is described in a new U.S.P. of J. N. Tuttle, Inc. (B.P. appl. 10,139/45). For other special sealing methods *see* B.P. 554,904, 560,848, 566,306.

Influence of Corrosive Conditions

The true finishing method to be adopted and the appropriate phosphating beforehand depend on the severity of the corrosive conditions to which the surface is to be exposed. If an oil finish is thought to be sufficient from a protective and decorative point of view, or possibly a thin one-coat painting, then a somewhat thicker and perhaps slightly coarser phosphate coating, such as that of ordinary Parkerising, will meet the case. Various methods may be used for oiling, such as centrifuging, spraying, etc., and among the great variety of oils may be included different paraffin fractions. Even with simple oiling a decorative effect may be obtained by embodying a colouring pigment (Parker, Fr.P. 694,869, or Tucker, B.P. 420,461). One or two other methods of achieving a colourful effect have been noted previously.

A thin, compact, and finely crystalline coating is usually regarded as the best for application of a paint varnish, or enamel For example, in the Bonderising process a layer of very fine crystals is formed, integral with the metal underneath, and providing effective paint adhesion. The applied paint or enamel flows into the interstices

between the crystals and when dried is securely anchored to the metal. Phosphate coatings, being insoluble in water, effectively resist corrosion by water that may penetrate the paint or varnish film, and they thus increase the life of the paint itself. This is further supported by a consideration of the electrochemical theory of corrosion and of paint film failures.

Oil Adsorption Powers

In their work on phosphating as an aid to metal working, Dürer and Schmidt (*loc. cit.*; p. 38) describe the various oil-adsorption powers of different types or thicknesses of phosphate coating. Test plates were degreased and phosphated for 15 sec., followed by wetting or rinsing with machine oil. The phosphated plates, though treated for only 15 sec., held twice as much oil as the unphosphated. A rather surprising result was obtained from tests to determine effect of thickness of coating. Several plates were phosphated for periods varying from 15 sec. to 15 min., the thickness, after 15 min. being four times that of the 15-sec. treatment. Irrespective of thickness, oil adsorption remained nearly the same, and the authors conclude that the oil does not permeate the whole depth of the coating through capillary action, but is held essentially by the roughened surface. This seems to require further confirmation and study. Paint technologists have long realised the importance of adsorption and other surface characteristics on the quality of a paint coating, and this intricate subject cannot be dealt with further here.* It may be of interest, however, to note the so-called phosphating paints, in which a phosphate preparation is applied as a paste or paint. In fact, it is often claimed that the ordinary process of phosphating may be carried out either dipping or spraying, or by brush.

In Burstenbinder's B.P. 410,323 a phosphating preparation is described consisting of binding material, rust-dissolving acid, and an organic acid or salt. For example, phosphoric acid or a volatile acid such as formic is mixed with tannic or other, and the mixture incorporated in cellulose or other varnish. Reaction is said to take place with formation of an organic iron salt. In B.P. 467,839, the Grasselli Chemical Co. uses phosphoric acid plus a sulphonated product of alcohol, or salts (esters) of the latter, *e.g.*, stearyl or cetyl alcohol, sufficiently viscous to apply to vertical steel panels; and in B.P. 470,452, T. B. Unger claims a phosphating paste or liquid (addition to B.P. 468,951) for large structures, used in paste form with dextrine or kieselguhr or glycerine. Other similar patents in this line are B.P. 513,030 (Sterling Varnish Co., U.S.A.) for electrical insulation; B.P. 530,006 (Pyrene Co., Ltd.) containing zinc phosphate, chromic acid, free phosphoric acid, and a wetting agent such as Duponal WA paste; and Schamberger's G.P. 641,725.

While galvanising or other form of metal coating has been proposed as a preliminary to phosphating, the converse is also practised; and nickel plating, *e.g.*, on a phosphated surface was proposed in W. Clark Parker's patent (U.S.P. 1,211,218), and later in U.S.P. 1,887,967 and 1,888,189, or B.P. 346,401 (Parker Rustproof Co.). In B.P. 494,503, of H. Davies, iron and steel are phosphated and then coated with one or more layers of lead, tin, tellurium, or antimony, singly or superposed; and the phosphating may be done chemically or electrolytically.

Renewing the Bath

As the constituents of the solution are not equally or uniformly used it is of course necessary that the regenerating solutions or mixtures shall be carefully controlled accordingly. In restoring alkaline nitrate baths, where only the nitrate ions are used and not the alkali, the Met. Fin. Research Corp. (Parker) uses, instead of alkaline nitrate, nitrates whose basic constituents pass into the coating as phosphates, *e.g.*, of the metals, Mg, Ca, Ba, Sr, Mn, Zn, Cd, Fe, or those of which the basic constituents evaporate at high temperatures, such as boron nitrate (B.P. 427,921, Fr.P. 770,798, G.P. 643,869). In order to maintain the efficiency of zinc phosphate baths the Metallges. A.G. has found that the composition both of the original and of the restoring solutions must be controlled within strictly defined limits (Fr.P. 805,845). The restoring solution contains zinc phosphate and zinc nitrate in which the phosphate/nitrate ratio is from 2.5 : 1 to 1.5 : 1. The original solution must have at least 10g. Zn/l., and the ratio of free to total acid should be 1 : 4 to 1 : 5. *See* also U.S.P. 1,949,090, 2,097,211, and B.P. 473,974.

In phosphating iron in non-ferrous heavy metal phosphate solutions (Zn or Mn) the baths accumulate iron and become unworkable. This increasing concentration of iron phosphate may be prevented (Pyrene, B.P. 477,910) by adding an oxidiser such as potassium permanganate or hydrogen peroxide to oxidise ferrous to ferric phosphate, thrown down as sludge. In B.P. 484,726 of the same firm an oxidising effect is said to be achieved also by suitable arrangement of pumps and filters so that the solution is subjected to atmospheric oxidation by spraying. *See* also Parker, Fr.P. 835,312. In phosphoric or other acid pickling baths (pre-cleaning) regeneration is accomplished by addition of acid, usually sulphuric; and

* A great deal of work has been done with certain types of synthetic resin varnishes for finishes after phosphating, etc. Results from an anti-corrosion point of view are said to be very good.

they hardly belong to the present category phosphating baths. But in B.P. 447,524 of Matières Colorantes-Kuhlmann it is proposed that part of the used or exhausted pickling bath, before regeneration with acid, may be diluted and used as a second bath of acid iron phosphate to form a supporting film for paints or varnish. Another French method, that of R. Jacques-Kahn of Paris (B.P. 526,326), discusses various causes of weakening of bath and proposes among other things addition of caustic soda or carbonate to restore pointage, by neutralising excess acidity, *e.g.*, manganese carbonate together with compounds of hydrosulphurous acid and also aldehydes (acetic or formic) including a product under the trade name of "Rongalite."

Phosphating Non-Ferrous Metals

Among the earlier methods for phosphating non-ferrous metals are those of the Soc. Continentale Parker (Fr.P. 698,699, 710,042, 714,321, and 732,230) for protective coatings on aluminium, magnesium, and zinc, and their alloys. Besides phosphates the solutions also contain chromate, sulpho-molybdate, alkali carbonate, tartaric and citric acids; or for magnesium, nitrate, arsenate, and oxidising agent. For *zinc* and its alloys Parkers propose (U.S.P. 2,082,950) zinc or manganese phosphate solutions containing iron salts to the extent of one-half to one-third of the zinc content, or twice the manganese content. The Patents Corp. (B.P. 487,851) uses a zinc phosphate and iron phosphate solution in which the iron is about 0.15 per cent. and the zinc 0.39 per cent. The American Chemical Paint Co. proposes zinc phosphate solutions containing nitric acid and nickel or cobalt salts (B.P. 493,365); and in the earlier Pyrene Patent (B.P. 394,211) for phosphating a zinc or galvanised surface, ferrous sulphate is used as accelerating agent, together with phosphoric acid and other acids, and nitrate, nitrite, or sulphide.

For both zinc and *magnesium* as well as iron the Pyrene Co., in B.P. 397,879, proposes that the hot acid phosphate solution should contain a metal less basic than the metal to be coated. The methods used for iron and steel by the Met. Fin. Research Corp. (U.S.P 1,949,090), the Patent Corp. (U.S.P. 2,067,007) and Parker (G.P. 643,869) are also claimed as adaptable to zinc and magnesium. The Dow Chemical Co. (U.S.P. 1,947,122) propose alkaline-, alkaline earth-, magnesium-, or ammonium-phosphate solutions containing also the chromic, tungstic, or metavanadic salts of similar bases. Renault (Fr.P. 805,551) suggests hot manganese phosphate solutions; and similarly Badaljan (Russ.P. 45,482), who in Fr.P. 805,845 recommends solutions containing manganese and iron phosphate, sodium fluoride, or sodium silicofluoride. The coating is said to consist of complex phosphates together with magnesium fluoride.

A considerable amount of research has been done towards finding an efficient method of phosphating *aluminium*, and some success has been achieved; but it remains to be seen whether phosphated aluminium is comparable with the best and latest results of anodic oxidation and/or plating. In the early days Brunskill (B.P. 169,884) claimed a process for phosphating aluminium alloys, by boiling in alkaline solution (caustic soda), steaming, and treating with a zinc-iron-phosphate solution; and in B.P. 396,746 H. C. Hall proposed immersion in hot solution of phosphoric acid in ethylene glycol, glycerol, and the like. In B.P. 441,088, the Pyrene Co., for phosphating aluminium or non-copper alloys thereof, uses a solution or paste of alkali metal carbonate, chromate, and one or more neutral alkali metal salts, such as sodium hydrogen phosphate, sodium chloride or nitrate, up to 1 per cent. or corresponding potassium salts, at 90-100° C. By addition of caustic soda and higher concentration of solution it is claimed that temperature may be reduced. The Granodine process of the Am. Chem. Paint Co. is said to be suitable for phosphating several non-ferrous metals and their alloys.

Special Uses

The use of phosphated blackplate as a substitute for tinplate has attracted some attention in the U.S.A. during the past two or three years, and in Germany for much longer. A comprehensive paper on the subject was published by the research staff of the Metallges. A.G. (*Stahl u. Eisen*, 1942, *62*, 685). Its suitability for food containers has been discussed at length by Luck and Brighton in U.S.A., and by Adams and Dickinson in this country (paper read before Iron and Steel Inst., Autumn Session, 1945); and is also referred to by Hoare and Hedges in their new book on Tinplate (London: Edw. Arnold & Co.). We have already seen that the Parker-Pyrene group has taken out several patents for phosphating steel sheet or strip for fabrication into cans. This has been done on a large scale in the U.S.A. where, among others, the Bethlehem Steel Co. has erected a large plant for this purpose.

In Germany about 1937 two of the leading firms in the sheet-metal industry approached the Metallges., namely, the D. Z. Blechwarenvertriebs G.m.b.H., of Leipzig, and the Blechwarenfabrik Fritz Züchner, of Seesen, and as a result a fairly considerable plant, erected by Maschinenfab. Göhring, etc., for the latter company, started operations in 1938. This bonderised and lacquered blackplate is said to have been in extensive use in Germany just before the

war, and was known under various trade names: Lemnadose, Oftadose, Bonderdose, etc. The plant was afterwards enlarged to an hourly capacity of some 5000-6000 containers. *See* Swiss P. No. 207,211, of the D. Z. Blechwarenvertriebs. The finishing treatment applied *after* the cans had been fabricated—as also was the phosphating—was accomplished with oven-dried synthetic resin lacquers. The Metallges. workers (*loc. cit.*) discuss in some detail the need for careful pre-treatment, in which sandblasting was preferred; the choice of the right type of Bonderising, giving a thin and finely crystalline phosphate coating; and the superiority of welding the can seams over soldering. It is interesting to note, too, that rather wide differences were found in the efficiency of the different lacquers tested, though these are not definitely specified, and are merely referred to as A, B, and C. B, whatever it was, proved to be by far the best.

Aid to Lubrication

Possibly an even more important application of phosphating as an aid rather to lubrication than anti-corrosion—though the latter is also required—is in the sheet-metal shaping and forming industries, and especially in the deep drawing of metals; also where there is moving contact of metal to metal and risk of scuffing or seizing or welding, *e.g.*, with piston rings, and gears, to which some reference is made below. Jevons in his *Metallurgy of Deep Drawing* (2nd ed., 1941) has rightly drawn attention to the supreme importance of efficient lubrication and indicates in detail the particular requirements of such. As early as 1921, J. H. Gravell (founder of Am. Chem. Paint Co.), in U.S.P. 1,428,087, proposed a thin coating of iron phosphate on steel before rolling, drawing, etc., specifically to inhibit corrosion and without explicit reference to lubrication—though this latter may have been implied. But several years later the Am. Chem. Paint Co. in B.P. 512,594, definitely claimed the lubrication of bearing and rubbing surfaces of ferrous metal parts by means of phosphating and oiling. By that time, however, reference had to be made to the earlier work of Singer (B.P. 455,077, or G.P. 673,405) and to the use of Granoseal phosphating for piston rings to avoid scuffing (*J. Soc. Auto. Eng.*, 1937, *41*, 495). *See* also Metallges., B.P. 494,830, 496,866. In some of these patents phosphating is said to aid by increasing oil adsorption through capillary action; but as pointed out elsewhere by Dürer and Schmidt (*loc. cit.*) such capillary action is denied and adsorption is due entirely to roughened surface.

Ducas, in Fr.P. 812,022, has recommended phosphating and included a tanning solution and graphite suspension; and Tufts, in U.S.P. 2,008,939, suggests the use of alkali and ammonium phosphates as lubricants instead of the oil type: they are more easily washed off than oil. Wetting agents, too, may be used, and, to prevent too rapid drying, glycerin or di-ethylene glycol is recommended. The phosphating of steel articles in the hardening process to avoid burning or overheating, and its use in shaping cast iron parts to prevent seizing, is proposed by Metallges. (G.P. 694,148).

The favourable results obtained by phosphating in the prevention of scuffing of piston rings, etc.—already well known—induced the Automobile Research Committee of the Institution of Automobile Engineers to try similar methods with gears. Several different kinds of chemical surface treatment were tested, including seven types of phosphating—divided roughly into the zinc group and the manganese group—as well as the caustic soda/sulphur treatment (presumably Surfiding), electrolytic tinplating, colloidal graphite anodically deposited, and a nitric acid etching. The general conclusion is that the manganese type of phosphating is best for this particular purpose. *See* report issued by the I.A.E., and three articles in *Engineering*, Aug., 1945.

H. Gonschewski, in B.P. 429,220, has proposed the treatment of smooth castings, in mould or immediately after removal, with a sintering material such as stone powder and/or by phosphating, using a pulverised phosphorus compound, or dipping in hot water bath in which phosphorus salts are dissolved. These salts may be added to a hot water tempering bath.

(*To be concluded*)

Loss of Furfural

Experiments with Wheat Straw

A STUDY has been made by H. D. Weihe and M. Phillips, at the U.S. Bureau of Agricultural and Industrial Chemistry (*J. Agr. Res.*, 1946, *72*, 163) to determine the extent of loss of furfural-yielding constituents at different stages in the isolation of the hemicelluloses of wheat straw. Partial delignification of the wheat straw with a 2 per cent. solution of sodium hydroxide in 50 per cent. ethanol caused a loss of furfural-yielding constituents which amounted to 7.79 per cent. of the total furfural. Wheat straw which had been partially delignified with a 2 per cent. solution of sodium hydroxide in 50 per cent. ethanol and then subjected to the successive action of cold 4 per cent. aqueous sodium hydroxide solution, cold 2 per cent. solution of sodium hydroxide in 50 per cent. ethanol, cold 4 per cent. aqueous sodium hydroxide solution, and finally boiling 4 per cent. aqueous sodium hydroxide solution, suffered little or no loss of furfural-yielding constituents.

Society of Chemical Industry

The Annual Meeting and Luncheon

THE 65th annual meeting of the Society of Chemical Industry was held on July 12 at the Connaught Rooms, Great Queen Street, London, W.C.2, and attracted a large attendance. The morning session was devoted to business and to the presidential address by Dr. Eric K. Rideal, F.R.I.C., F.R.S., who is Professor of Colloid Science in the University of Cambridge and becomes Fullerian Professor of Chemistry in the Royal Institution and Director of the Davy-Faraday Research Laboratory on the retirement of Sir Henry Dale on September 30.

Luncheon was followed by the presentation of the Messel Medal to Dr. Wallace P. Cohoe, M.A., LL.D., who afterwards delivered an address. Dr. Cohoe, president of the Society in 1943-44, was formerly Professor of Chemistry at the McMaster University and is now a consulting chemist and engineer in New York. A member of the American Chemical Society, the American Institute of Chemical Engineers and other scientific bodies, he has specialised in the chemistry of paper and pulp, dyestuffs and synthetic resins. He was chairman of the Canadian Section of the Society in 1912 and of the American Section in 1939-41.

Royal Patronage

At the outset of the annual meeting, Professor Rideal announced that the King had honoured the Society with his patronage for the year. He proceeded to read out a telegram of loyal greetings which had been sent to His Majesty in the name of the members, and the telegram which had been received in reply, conveying the King's grateful appreciation. On behalf of the English members, the president welcomed members from overseas and others who had come from a distance. He expressed the hope that there would be further overseas sections in the not too distant future.

The hon. foreign secretary, Mr. Stanley Robson, read a cablegram from the Canadian Section, conveying best wishes for a successful meeting and congratulations to Dr. Cohoe on being awarded the Society's medal, also another from Mr. Bartram, a vice-president of the Canadian Section, in similar vein. Messages from the American Section expressed appreciation of the award of the medal to Dr. Cohoe and gratification at the recent visit to America of Professor Rideal. There was a further message from Dr. William Cullen, who is now in South Africa and was unable to be present.

The president commented that the meeting was almost a unique occasion, inasmuch as they had with them two past presidents from the American Section, Dr. Cohoe and Dr. Marston T. Bogert. Going on to propose the election of Dr. L. H. Lampitt as president of the Society for the ensuing year Professor Rideal remarked that recently they had seen a resurgence of the position where chemists took a leading part in the conduct of the industry rather than financiers and others. Possibly one of the most important of the modern chemical industries was the food industry and it was clear that the chemical director of the largest food industry in the world was an obvious choice as president of the Society. Apart from that, the Society owed an enormous debt to Dr. Lampitt, especially for his efforts towards the co-ordination of the interests of chemists, not only in this country, but throughout the world.

Elections

The election of Dr. Lampitt to the presidency was carried with acclamation. Professor Rideal, Dr. L. A. Jordan, Mr. C. S. Kimball (secretary of the American Section), and Dr. R. T. Colgate were elected vice-presidents. Mr. Julian Leonard was elected hon. treasurer in place of Dr. Lampitt; Mr. Stanley Robson was re-elected hon. foreign secretary; and Mr. E. B. Anderson and Mr. W. H. Cremer were re-elected hon. secretaries. Dr. H. Baines, Mr. C. Diamond, Mr. F. P. Dunn, and Mr. W. C. Peck were elected ordinary members of the Council in place of the members who retired.

The Annual Report

The annual report of the council for 1945 stated that despite the inevitable and uncomfortable aftermath of six years of war on a scale never before endured, chemists could now look forward to following their vocation in the interests of peace and to the rehabilitation of a shattered world economy. The part which the Society would play in this should be no mean one; already some of the plans for development which had been made during the war years had been put into operation during the year under review. The first step had been the appointment of an editor and manager for the Society's publications.

Dr. R. T. Colgate had resigned his office of joint hon. secretary and was succeeded by Mr. H. W. Cremer. Appreciation was expressed of Dr. Colgate's services, also those of the outgoing president, Professor Rideal, and the other officers.

The increase in membership, recorded the previous year, had been continued, 834 new

members being elected during the year, while deaths and resignations totalled 148, so that once again a new high level of 6667 members had to be recorded, against the 1944 total of 5981. Seventy-eight joint student members were enrolled. The Society's income exceeded that of the previous year by about £800 and that of 1938 by £5000. Subscriptions showed a notable increase, £1400 over the previous year.

The council had decided, together with the other supporting bodies, that the Bureau of Abstracts should conduct its own book-keeping. This decision did not take effect until the middle of 1945 and no final figures were available to be included in the accounts, but it was reported that the outside sales of the abstracts had increased. It was a coincidence that in its 21st year of service the Bureau should become incorporated. During the year the Bureau received for the first time a grant of money direct from the Chemical Council.

Awards during the year were as follows: The Society's medal, Lord Leverhulme; *American Section*: Perkin Medal, Dr. Francis C. Frary; Chemical Industry Medal, Sidney D. Kirkpatrick; *Liverpool Section*: S.C.I. prizes, R. Blunt (senior), W. F. McDonald (junior), J. D. Speedy (special merit); Hunter Memorial Lecture, Dr. R. E. Slade; Leverhulme Memorial Lecture, G. Parker and J. H. Thomas (divided); *Newcastle Section*: Saville Shaw Medal, K. H. Jack. The John Gray scholarship was not awarded.

The Chemical Council was pursuing its endeavours to find ways and means of providing accommodation for the main chemical bodies. Exploration of the possible facilities generously offered by a City company was proceeding, and the council was alive to the urgency and importance of the matter to the chemical fraternity.

A communication had been received from the Chemical Society stating that its council had adopted proposals which would provide a 50 per cent. increase in seating accommodation in the Chemical Society's library and for additional accommodation for books to allow for normal expansion of the library for at least six years. The Chemical Council made a grant of £338 to the library towards the cost of maintenance.

Colloid Science

Points from the President's Address

IN his presidential address, Professor Rideal decided to deal with an important scientific topic rather than a subject of general character. He chose as his subject Colloid Science, a branch of science on which he is specially well qualified to speak, and one which will play an ever-increasing rôle in chemical industry.

Beginning with a historical review, the President recalled how Sir William Hardy was led to study the electric charges on proteins in solution and the complexes known as the lipoproteins. He came across, in the course of his study, a great variety of new and unexpected properties of matter which now form the corpus of the science of colloids. General principles were soon laid down which ensured, although not clearly understood, the formation of the material in the colloid form. It was then realised that materials could be prepared in various forms and that they were all polyphase macro- or micro-heterogeneous systems, including interfaces, membranes, and jellies.

It was only natural that attempts should be made to examine the possibility of determining the conditions of equilibrium in colloidal systems; and this second phase of the development of the subject has been enriched by many important thermodynamic relations such as the classical equation of Willard Gibbs for equilibrium conditions at interfaces or the relationship between vapour pressure and curvature, of Lord Kelvin.

A great impetus was given to this phase of the subject by the investigations on osmotic pressure of non-aqueous solutions of polymeric materials. Meyer's observations on polymeric molecules were followed by the thermodynamic treatment of Huggins and the experimental work of Gee; and a great debt is due to the Uppsala school under Svedberg for the development of the ultracentrifuge and its application to disperse systems. The position in respect to solutions of colloidal electrolytes and colloid systems in which electrical charges are present is by no means so satisfactory. The pioneer work of Pauli led to the concept of the colloidal particle as a large multivalent ion; and attention was directed to the problem of ion exchange at the surface of the particle. The retention of the so-called "gegen" ions by electrostatic attraction and the development of the zeta potential have been treated in a formal manner and measurements have been made on many of the electrokinetic properties of colloidal systems, but our knowledge is still very incomplete. Recently, attention has been drawn to two major problems in this field, firstly, how the electric forces between charged ions in aqueous solution can be calculated when they are but a small distance apart, and secondly, what is the range of molecular interaction. X-ray examination of colloidal solutions has revealed a number of characteristic long spacings, and it has been suggested that molecular action may have a considerable range. It seems more likely, however, that while ionic interaction may

be extensive, the range of dipolar action sufficiently strong to overcome the normal thermal agitation does not have a greater range than, say, two molecular diameters.

Our knowledge of the kinetics of equilibrium is firmly established in the movement and equilibrium of small particles undergoing Brownian agitation, but the study of the interaction of a solid surface phase with a gas or vapour has led to some confusion. The distinction between Van der Waals and chemi-sorption is now fully recognised, but the general problem of condensation and evaporation is by no means completely solved. Although some information on accommodation and condensation coefficient is available, we do not as yet known the detailed molecular balance in those stages of transition between a solid-vapour and a solid-liquid interface.

The third characteristic stage in Colloid Science lies in the development of the reaction kinetics obtaining in such systems. It is investigations in this field which have so important a bearing on modern chemical technology. Investigations on nucleus formation and nucleus growth play an important part in regulating the growth rate of crystals from supersaturated solutions in the control of the crystalline form and in the sensitivity of the photographic film; while new applications of the reaction kinetics of chain reactions are to be found in the production of polymeric macromolecules.

Review of Plastics

The growing importance of synthetic polymers and plastics is reflected in the activity of the group of our Society devoted to these matters. Along with the growth of the plastics industry, we are impelled to pay more attention to the properties and behaviour of matter in the fibrous state. On account of its great economic importance, it is, I think, essential that there should be a survey within the industry of the field of plastics in this country. It is evidently the duty of the plastics industry itself to ensure firstly, that our universities and research centres devote sufficient attention to the subject of polymers, so that well qualified chemists, physicists, and engineers can continue to enter the industry; secondly, that technical colleges and schools may provide courses so that there may enter the industry people skilled in the manipulation of plastic materials; and last, there should be a survey of our potentialities in raw materials so that we may be able to provide all forms of plastic materials in spite of the fact that some of these may be unremunerative from a production point of view.

Great advances have been made in our knowledge of such materials as paints, and fillers such as carbon blacks, due not only to a more proper appreciation of the factors which govern the formation and stability of thixotropic and dilatant systems, but also by the introduction into industry of modern apparatus such as the electron microscope, for examination and control. It is hoped that similar progress may be made with those interesting disperse systems, the coloured plastics and stained glass. Very little of the modern stained glass is comparable in beauty and brilliance to that made by our forefathers and preserved in our churches and cathedrals. Still another dynamic process which is of great interest is that of the flow of gases, vapours, and liquids through and into membranes.

Left: The new president, Dr. L. H. Lampitt. Right: The outgoing president, Professor E. K. Rideal.

Reactions at the solid-liquid solid-gas, and liquid-liquid liquid-gas interface are also of importance, not only in connection with heterogeneous catalytic processes and electrode reactions, but also in a number of textile and biological problems.

There is still another section of Colloid Science, the importance of which greatly exceeds that of the corresponding section in physical chemistry, namely, the conditions of solvent-solute equilibrium. The extension of our ideas on solvent-solute miscibility to swelling and syneresis is by

no means complete, the changes in entropy taking place on the solution of a crystalline macromolecule in a solvent greatly exceeding that of an ordinary small molecule, and playing a dominant part in the equilibrium of such systems. We have but slight appreciation of the electrical factors that govern the transition from thixotropic to dilatant systems, but several sections of our Society are devoted to the manufacture and use of materials in which these solvent-solute relationships are all important.

The academic investigations into the properties of and the reaction kinetics in monolayers at liquid surfaces are beginning to have their repercussions in the development of industrial emulsions used for a variety of purposes. The discovery that complexes can be formed in the boundary phase which are relatively stable and readily formed by penetration is a factor which affects the efficiency of such systems when used for germicidal or insecticidal purposes.

Interest in foams has again been revived. The technical developments in fire-fighting liquids, in soft sponges of different plastics, and both plastic and metallic foams like substitutes for balata wood, reveal a new and wide variety of interesting materials.

In Colloid Science there are numerous interesting problems, interesting to the mind both lay and academic; to chemical industry it is the key for the proper appreciation and development of methods to produce materials in new guises, materials with novel properties and producing new effects.

Annual Luncheon

At the annual luncheon, a welcome revival, which was attended by a large and distinguished gathering, Sir John Anderson, after the loyal toast, proposed "The Society." It is permissible to mention in parenthesis that Sir John's frequent attendance at the meetings of scientific societies gives rise to the hope that the importance of scientific industry is being increasingly recognised by the statesmen of this country. Sir John made reference to his early training in science, but reminded his audience that in the early years of the century there was precious little indication of any belief that science could do much for the industry of this country, which was then still based on empiricism. The salaries of chemists and dustmen were about on a level. He regarded his later preoccupation with scientific industry as part of the result of the unstable and irregular wanderings of his early days, which ended with his appointment to a position in the Civil Service. The outbreak of war in 1914 found him in the responsible position of Secretary of the National Insurance Commission, at a time when we were relying exclusively on Germany for our supplies of synthetic drugs. They succeeded in mobilising the Royal Society, the Universities, and the comparatively few firms who were doing anything in the chemical industry—outside the healthy heavy chemical industry and the excellent output of certain alkaloids—and they managed to supply insured persons, the British Army, and, incidentally, the Russian Army, with everything in the way of fine chemicals they needed. This was, in fact, the beginning of the fine chemical industry in this country. He laid emphasis on this in order to bring out the spectacular and tremendous development of the fine chemical industry since those days. Such was the development that—to take an instance from the late war—the British commanders in Burma actually sought out the *unhealthy* places in which to meet the Japanese, so ill-provided were the enemy, and so immune were our troops, against the customary scourges of the district. Sir John asked for a still better understanding between the industrialist and the scientist. If the Society of Chemical Industry played its part, the prospects were indeed favourable.

A Healthy Symptom

Professor Rideal, in response, expressed the Society's gratitude to Sir John for his benign influence on the chemical industry of the country, instancing his interest in the petroleum by-products, which had made possible the development of an industry based on them. The coupling of technology with pure research was a healthy symptom of the times, and he assured his hearers that the Society would do its best for the progress of the industry during the period of reconstruction as it had in time of war. To make the future of all more certain, he appealed for a greater measure of international understanding and intercommunication among scientists.

The health of the guests was proposed by Sir Robert Pickard, and he made special reference to Sir Alfred Egerton, one of the secretaries of the Royal Society, who, by virtue of his appointment as Professor of Chemical Technology, was a living proof of the fact that Fellows of the Royal Society were not so "pure" as they were sometimes claimed to be. Sir Robert paid a graceful compliment to the presence of the lady guests, with special reference to Mrs. Rideal, Mrs. Lampitt, and Mrs. Cohoe. Sir Edward Salisbury, responding, referred to the importance of realising the fundamental unity of all knowledge, and to the importance of developing links between various scientific subjects. The proceedings concluded with the transference of the regalia of office from Professor Rideal to the new president, Dr. Lampitt.

Medallist's Address

Dr. Wallace P. Cohoe, on whom the award of the Society's Medal was conferred,

dealt in his address with "Science and Anglo-American Relations." He said the manner in which Mr. Winston Churchill's addresses had been received in America indicated not only a desire for continued Anglo-American friendship, but also for active co-operation in the interests of world peace. In contrast to the impermanence of political and social movements, there was in science the only human agency which was truly permanent, cumulative, and transmissable; but in the realm of human conduct it must regretfully be confessed that there was no body of organised knowledge which had yet attained sufficient stature to be called Science. Despite that deficiency, however, they were sure that humanity was war-exhausted and war-weary; that it longed for peace and security; that it hoped to forge a key that would open the temple of world peace. In the forging of that key it was his belief that science might be a major force

Gradually, and in the last few years—as human history went—Science had become dominant. In the last few months it had become predominant. That predominance had made obsolete the former means of national offence and defence. It was a predominance that held the world in its hands, which had the power to destroy humanity, and it had been consummated for war purposes by scientists working together toward a common objective in Great Britain, Canada, and the United States. If those three nations could work together for purposes of destruction, it should be possible for them to work in the cause of world peace.

Service to Humanity

The cry had gone up to "stop Science," but no human agency existed with the power either to retard greatly, much less to stop, Science. Science should and must never become a cancerous growth in the body politic On the contrary, it asked for nothing better than to be allowed to be of service to humanity. After remarking that the conversion of physical superiority into moral leadership called first for some study of certain present-day conditions, Dr. Cohoe referred to the way human ideas were slowly moving to the left; to the inexperience of newly organised nationalities which, as yet, were unaccustomed to the civilities of the comity of nations; and to the fact that in those nations concerning whose future intentions there may have been some doubt, science was enthroned.

The scientific leadership and pre-eminence possessed by the English-speaking nations at the present time centred around the release and control of atomic energy. While chemists and physicists were entitled to look upon their accomplishments in sub-atomic energy release with some complacency, it would be unfortunate to overlook the scientific work which had been done for the preservation of the health of the human race. It was curious that in the study of chemical therapy there should have been a long hiatus between the work of Ehrlich and the discovery that the sulpha drugs were useful in

Dr. Wallace P. Cohoe.

conquering human disease. Those products bestowed upon the physician means of combating disease which he had not hitherto possessed. The discovery of penicillin in England opened up a new world in the treatment of disease. The field of biochemistry and chemical therapy was beginning to receive an attention which it had reserved for a long time.

Pure science needed no urging to go forward. When they contemplated the extent of their ignorance it was not surprising that any well-directed exploration into the unknown was sure to discover something of value. Every lady who treasured her "nylon" stockings was bearing witness as to the value of an excursion into the unknown by pure science. In all that, however, pure science must recognise its dependence on technology.

TECHNICAL APPOINTMENTS

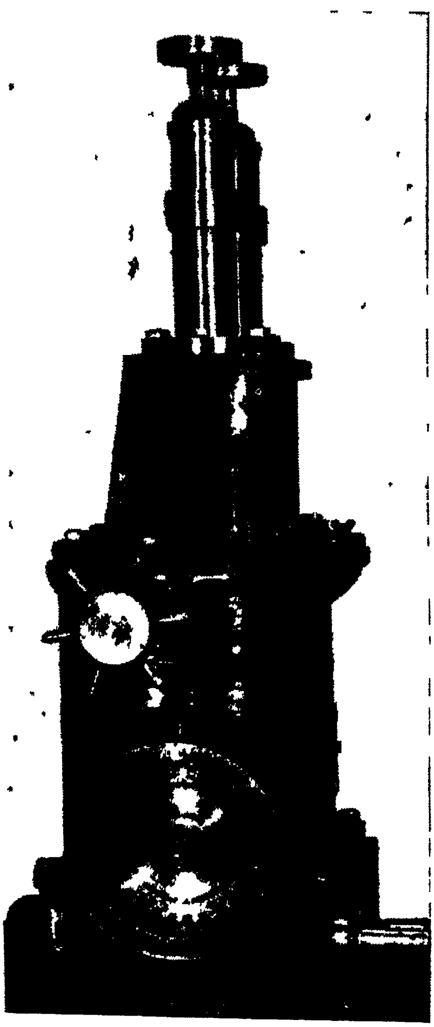
The Technical and Scientific Register of the Ministry of Labour Appointments Department, which operates from York House, Kingsway, London, W.C.2, has the benefit of the guidance of advisory committees, composed of leading representatives of the various professions catered for by the Register, to ensure that it is providing the greatest possible service to employers seeking professionally qualified technical and scientific staff, and to those seeking appointments. Among the chairmen are Sir Robert Pickard (chemistry), and Sir Lawrence Bragg (scientific research).

New Proportioning Pump

A Peter Brotherhood Production

A NEW "Brotherhood" metering and proportioning pump, which claims to be an entirely new development in precision measurement and blending of fluids and gases, has been produced by Peter Brotherhood, Ltd., of Peterborough.

The pump is stated to be particularly suitable for: (1) proportioning anti-knock compounds to petrol; (2) proportioning chemicals



The New "Brotherhood" Pump.

for bleaching fabrics, paper pulp and control of colouring matter; (3) treatment of water to effect coagulation, injection of sterilising media, either as gases or liquids, to water and industrial effluents; (4) boiler-water treatment; (5) controlled pumping and metering of catalysts; and (6) blending of pharmaceutical products, and emulsification of oleic and aqueous solutions.

It is designed to deliver liquids or semi-gaseous liquids up to pressures exceeding 250 atmospheres. The understructure is of compact and robust construction in which a camshaft, supported by four bearings and rotated by worm and worm-wheel, operates tappet-type plungers kept in contact with the cams by springs. The effective length of the plungers, which controls the output of the pump, may be varied at will while the pump is running by means of telescopic members screw-threaded one within the other and operated through spiral gears by the manual adjustment of a micrometer handwheel.

The arrangement permits each plunger to be operated independently, if desired, to give a variable discharge from one or more of the cylinders, and provides an accurate means for delivering predetermined quantities. Camshaft, cylinders, and plungers are made of hardened nitrided steel.

Full specifications are provided (in Prov. Pat. No. 13726/46). It is recommended that one liner and plunger as a selected assembly should be provided as spares. A suitable driving motor (electric) can be provided as an extra if required.

LETTER TO THE EDITOR

Shellac Research Bureau

Sir,—My attention has been drawn to a notice in the technical Press which refers to the "winding-up" of the London Shellac Research Bureau. That notice is premature. Both the Indian Lac Cess Committee and the Government of India are at present considering the future of lac research in the United Kingdom, including the location of a research laboratory and the scope of the research work to be undertaken.

Dr. B. S. Gidvani has returned to India on termination of his contract with the Indian Lac Cess Committee. Meanwhile, Mr. A. J. Gibson, who was the Special Officer, Lac Inquiry, from 1929 to 1943, has very kindly consented to deal with inquiries on lac, and letters or telephone calls to India House, Aldwych, W.C.2 (TEMple Bar 8484) will continue to receive attention as in the past. I shall be most grateful to you if you will be so good as to give appropriate publicity to this statement of the present position.—Yours faithfully,

D. B. Meek
(Sir David B. Meek),
India Trade Commissioner.

London, W.C.2, July 10, 1946.

SAFETY FIRST

Amenity as a Feature of Chemical Works—I

by JOHN CREEVEY

FOR years longer than we care to admit, industry has been getting on with the job, without attaching sufficient importance to working conditions. Until comparatively recently, so long as the work was done, the uncongenial nature of the surroundings had often to be tolerated, and those who were dissatisfied remained in a state of endurance or sought other employment.

There was much of this in the chemical industry until employers with honest consideration for the welfare of their workpeople set out purposely to provide better environment and improved facilities for doing a particular job. The pioneers in this movement quickly realised that workpeople become a greater asset when everything within reason is done to ensure their comfort and cleanliness while working. Almost simultaneously there came some enforcement of better conditions under powers provided by the Factories Acts, and Inspectors of Factories did much to promote the contention that money spent in bringing tidiness to the works or otherwise making employment more acceptable was well spent for an ultimate return of profits.

Apart from this, a demand for better working conditions came from employees in certain industries which needed overhauling, not only from the cleanliness aspect, but from that of greater safety in hazardous occupations. A man no longer wanted to work in an environment that was not only uncongenial, but, as was often the case in chemical and allied works, an environment distinctly unpleasant and dirty. Some types of work were, of course, necessarily dirty, and perhaps likewise hazardous. But even in those conditions better amenities were sought. These included the provision of convenient facilities for washing, and for eating in the meal intervals; also, the provision of special clothing for men to wear while actually at work.

Influence of Conditions

To a large extent amenities and general conditions of safe working are interlinked. When the environment is good there is far less tendency for workpeople to become slovenly, careless, or distinctly negligent. A considerable number of common accidents is primarily due to little more than carelessness. This is greatly reduced under good working conditions, as where efficient ventilation with removal of all obnoxious fumes has a beneficial effect upon the activity of the brain, and suitable illumination, both artificial and natural, prevents eye strain and hesitancy in action. From a scientific point of view it has been proved that the brain becomes sluggish as a result of bad ventilation; the resultant condition of lethargy greatly increases negligence, no matter how willing the subject may be to attain efficiency in his tasks. Even apart from the tendency for accidents to occur by negligence, there is inability to avoid them when conditions tending to lead to an accident become evident.

Reduction of Accidents

Throughout the articles in past issues of THE CHEMICAL AGE, dealing with various ways in which greater safety in chemical works can be attained, great stress has been laid constantly upon conditions existing inside the works. Almost any improvement of conditions that are distinctly bad invariably results in a reduction of the accident rate. This can be proved by an inspection of accident records, provided they are kept conscientiously and are analysed at intervals. Even when apparently at a minimum, the possibility of accidents continually lessens, and improved conditions are then reflected in more efficient service by personnel and consequent greater output at less expenditure of individual energy, which in turn reduces the incidence of illness.

Foremost among amenities comes sanitation. This must be considered from various aspects, apart from the public health viewpoint. An adequate supply of safe drinking water, for instance, should be provided in all places of employment. Such water should be cool, and readily accessible, the immediate surroundings of the tap being kept conspicuously clean. If a safe source is not available, the water must be rendered safe for human consumption, in accordance with advice from a competent health authority or from a firm specialising in water-purification equipment. At those places where drinking water is available, there should be no source of water other than for drinking. At all sources of water regarded as unsafe for drinking, yet needfully provided for other purposes, there should be a notice pointing out that such water must not be used for drinking; further, reasonable precautions should be taken to ensure that any such water is not used in any manner other than that intended. Drinking water should not

be provided at any point on the plant where poisonous materials are in use, nor where there are likely to be obnoxious fumes or the accidental escape of poisonous gases. Special precautions must be exercised in the vicinity of rooms where lead products are handled. Drinking water is, of course, also provided with the usual lavatory accommodation, and here, as elsewhere, its intended use should be clearly indicated.

Drinking-Water Arrangements

In the provision of taps for the supply of drinking water, consideration should be given to a certain matter which, so far as I am aware, has never previously been commented upon. Some people have a habit of putting their lips to a tap when in need of a draught of water. This practice has extended to taps set apart as sources of water for drinking purposes only, and in this way disease can readily be transferred from one person to another. To prevent this, the orifice of the tap should be fitted with a wire cage, preferably made of nickel wire, which adequately prevents direct access of lips to the tap, but otherwise does not hinder the flow of water in a stream for filling a receptacle.

The provision of a common cup for drinking purposes should be prohibited. Where employers provide individual cups to be used but once, there should be an adequate supply of unused cups from a closed container and a receptacle for used cups. Arrangements must be made for washing the cups at intervals to keep pace with average use. Alternatively, it is possible to provide cups or beakers made of stiff water-resisting paper, which can be dispensed from the container singly and thrown into a receptacle as waste immediately after use; the cost of such beakers, if of small size yet convenient capacity, is not prohibitive when taken in the number that may be required per year. Where common cups are provided, it is possible to prevent the transmission of disease from them by keeping them immersed in a recognised non-poisonous antiseptic solution, from which they are removed and rinsed under the tap before use. After use, the cup is rinsed a second time and replaced in the antiseptic solution. The only caution to be exercised is that of not overlooking the replenishment of the solution at recognised intervals, say, each day or every three days. Although this is a reasonable safeguard in cases where the common cup cannot be avoided, it is necessary to rely upon employees to observe the conditions appertaining to the use of the cup.

If it is necessary to use ice for cooling drinking water, the construction of the container should be such that the ice never comes into direct contact with the water. Ice is often manufactured from a source of water which is not necessarily of high purity for drinking purposes; apart from that, it sometimes exhibits a certain affinity for bacteria present in the air, and any bacteria originally present will remain latent while the water is in the frozen state, so that it becomes dangerous immediately the ice begins to melt or from contacting the stream of water in a normal liquid state. As an alternative to ice-cold water at plant where excessive heat is encountered by employees, it is convenient to provide a supply of sodium chloride tablets. These should be kept in a closed container close to the drinking water, and directions as to their use should be marked clearly on the container.

Waste, or refuse, should be collected in suitable containers placed in desirable situations throughout the works. If the waste is liquid, or of such a nature that it is likely to decompose, the receptacle must be leak-proof and non-absorbent. Further, it should be capable of being emptied easily and thoroughly cleansed when necessary. The need for maintenance in a perfectly sanitary condition must be stressed. however apparent that may be, for good sanitary conditions in all situations are a matter of co-operation between users and those whose duty it is to keep things tidy and clean. The removal of sweepings, garbage and waste should be done outside working hours as far as possible, so that it does not become a general menace to health. On the other hand, if the accumulation of waste is likely to become unduly large, facilities must be provided to remove it at regular intervals during working hours, as all parts of places of employment must be kept in a sanitary condition.

The Vermin Question

Consideration must be given to preventing the entrance of vermin, especially rats. If the situation of the works is one where rats can come from a near-by sewer or canal bank, the services of a professional rat catcher should be employed at frequent intervals. If the nature of the material handled at the works, or packing material employed, favours infestation by rats, someone at the works should be detailed to trap or destroy the vermin as a routine duty. The provision of poisoned bait should be avoided; it is far better, in the absence of trapping, to adopt a recognised virus which is harmless both to domestic animals and to human beings.

Where the process utilises such material as waste paper, waste rag, hair, or the like, it must not be overlooked that this material is likely to carry and transmit the causative agencies of infectious disease; in consequence, it is wise to disinfect it before there is any extensive handling.

Plastics Industry and Gas Research

Economical Method of Softening

ALTHOUGH the question may not yet have been conclusively proved there is a good deal of evidence, as established by Megson and Pepper in 1940, pointing to the fact that coal is a natural bakelite in the formation of which polymerisation has taken place, and that bituminous coal is probably a polymer of monomers of moderate molecular weight. Whatever may be the truth of this matter, it remains a fact that the plastics industry owes much to the coal carbonisation industry for its basic materials. The which was fully investigated by the Fuel Efficiency Committee of the British Plastics Federation who, under the chairmanship of Dr. A. C. Dunningham, found a large field for potential fuel economies in plastic production.

The gas industry is paying careful attention to this aspect in all branches of plastics manufacture in which gas is helping to ensure the efficient operation of its various processes. This applies equally in drying processes for the highly specialised manufac-

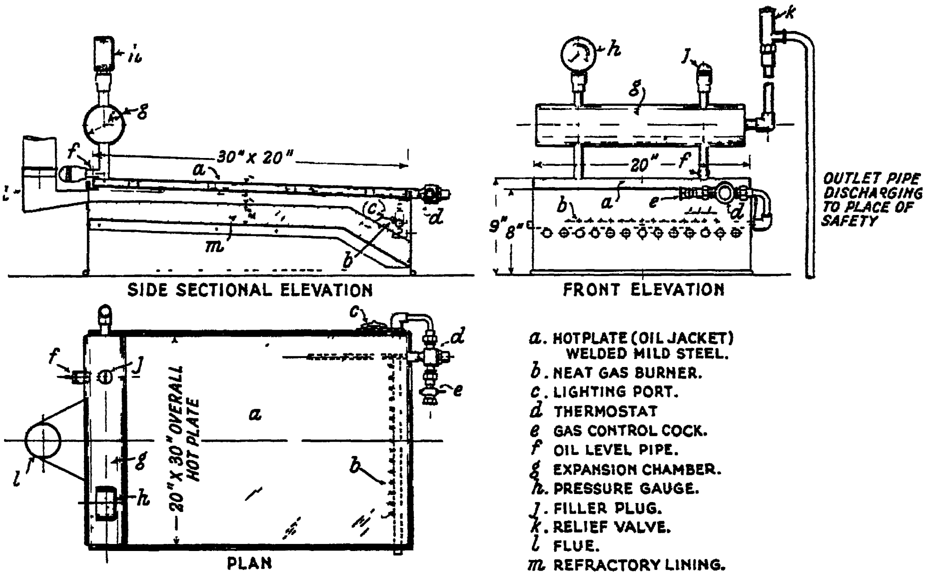


Fig. 1. Hot Plate for softening plastic strips.

list is formidable indeed and includes phenol with cresol and xylenol, benzene, methane with methanol and formaldehyde, urea, ethylene with phthalic anhydride and phthalic esters, and coumarone indene.

As the two industries remain so closely allied it is perhaps only natural that the plastics industry should be giving ever-increasing attention to the uses of gas for its heating processes, as the production of that gas from coal itself releases abundant valuable by-products, which are the root of plastics and are lost by the burning of raw coal as a source of power. Since it is a young industry, which has been extremely occupied with the many questions involved in its technical development, the plastics industry has not yet been able to devote full attention to its heating processes, a problem ture of moulding powders, as in the preheating of these powders and in improving the efficiency of presses for their moulding under the influence of temperature and pressure.

Nor does the matter end there; one of the industrial gas centres has evolved a simple method for softening plastic material prior to stamping. This method provides for the heating to be carried out on the surface of a specially designed hot plate since it is considered that this method is preferable, from the point of view of fuel economy, in cases where the heating of the plastic material is only carried out intermittently, continuous throughput not being required. The hot plate, as shown in Fig. 1, was designed for a concern manufacturing spectacle frames, and the plastic material in sheet

form is softened before stamping. The operator receives it in pieces 5¾ in. by 3¾ in. by 5/32 in. thick, from which two frames are produced. The pieces are put on the hot plate until they reach the required degree of softness, when they are put in the pressing machine. The heating surface of the plate, as will be seen from the diagram, consists of a hollow plate containing special high-temperature oil. The hot plate, which is hermetically sealed to prevent oxidation of the oil, is provided with a steel expansion chamber to which is attached a pressure gauge and pressure relief valve. The outlet of this valve discharges to a place of safety beneath the working bench.

The hot plate is heated by 15 neat gas jets mounted on a common float, and temperature is controlled by a rod thermostat immersed in the oil. The maximum gas rate of the burners is 45 cu. ft. per hour, and the required surface temperature of 120° C. is attained within 30 minutes from cold. When the thermostat comes into operation the required working temperature can be maintained at a gas consumption of 19 cu. ft. per hour. It has been found that the heating of the hot plate through the medium of oil has resulted in an evenness of temperature hitherto unknown over the plate's whole surface.

CHINA CLAY WORKING PARTY

The following members have been appointed to the china clay working party in addition to those whose names have already been published (*see* THE CHEMICAL AGE, 1946, 54, 289): Independent member, Mr. W. W. Varvill; employers' representatives, Mr. J. Keay, Mr. P. Harris and Mr. J. P. Goldsworthy.

Mr. Varvill is a lecturer in mining at the Royal School of Mines, South Kensington, and a consulting engineer. He previously managed gold and silver mines in the Gold Coast Colony and his other appointments included that of lecturer in mining at Birmingham University and surveyor at Mill Close Mines, Ltd., in Derbyshire, 1929-1936, and manager of lead, zinc, fluorspar and barytes mines in Yorkshire, 1919-1929.

Mr. Keay is managing director of English Clays Lovering Pochin & Co., Ltd., and joint managing director of English China Clays, Ltd. He has been associated with the industry since 1919.

Mr. Harris is works manager of Carpalla United China Clay Co., Ltd., and has been connected with the industry since 1913.

Mr. Goldsworthy is managing director of the Goonvean & Rostowrack China Clay Co., Ltd., and has spent a lifetime in the industry.

German Technical Reports

Particulars of Latest Publications

SOME of the latest technical reports from the Intelligence Committee in Germany are detailed below. Copies are obtainable from H.M. Stationery Office at the prices stated.

BIOS 465. *High temperature refractories and ceramics* (4s. 6d.).

BIOS 478. *Textile auxiliary products*: Development of Mersol and Hostapon processes by I.G. Farben, Höchst (5s. 6d.).

BIOS 485. *German filtration industry* (4s. 6d.).

BIOS 504. *Metallgesellschaft A.G., Frankfurt-on-Main*: Metallurgy: Notes on some subjects of research and laboratory activities (1s. 6d.).

BIOS 505. *Aluminiumwerke Göttingen G.m.b.H.*: Light alloy manufacture (1s).

BIOS 507. *Dr. F. Raschig, G.m.b.H., Chemische Fabrik, Ludwigshafen*: Coal-tar distillation; chlorinated phenols; phenol-formaldehyde resins; synthetic phenols (3s.).

BIOS 511. *Ruhr-Chemie A.G., Sterkrade, Holten*: Interrogation of Dr. O. Roelen: The Fischer-Tropsch synthesis and its products; synthetic lubricants; town gas and methanised gas for automotive propulsion (2s. 6d.).

BIOS 512. *Schlafhorst Chemische Werke G.m.b.H., Hamburg*: Lubricants (1s. 6d.).

BIOS 536. *Tall oil processing and utilisation* (1s.).

BIRMINGHAM UNIVERSITY

The Department of Oil Engineering and the Department of Coal Utilisation at Birmingham University have been combined to form a Department of Chemical Engineering, and Professor F. H. Garner, M.Sc., Ph.D., F.R.I.C., the present head of the Department of Oil Engineering, will be the Director of the Department. Professor Garner is president of the Institute of Petroleum.

Dr. Stacey Ward, who has been appointed to the Second Chair of Chemical Engineering, has been head of the Department of Coal Utilisation, and has been acting head of the Department of Mining since the the death of Professor Moss.

PHENOLPHTHALEIN PRICES

Monsanto Chemicals, Ltd., announce the first rise in phenolphthalein prices—due to greatly increased manufacturing costs—since October, 1944. The revised prices. inclusive of delivery in Great Britain and Northern Ireland, are: 1 cwt., 4s. 10d. per lb.; 28 lb., 5s. per lb.; 14 lb., 5s. 3d. per lb.; 7 lb., 5s. 6d. per lb.

The Chemical Society

Forthcoming Celebration of Centenary

IN July next year the Chemical Society will celebrate the centenary of its foundation. The celebrations would have taken place in 1941 but for the war, for it was "on February 23, 1841, that twenty-five gentlemen interested in the prosecution of chemistry met together at the Society of Arts to consider whether it be expedient to form a Chemical Society." Those twenty-five gentlemen did deem it expedient and so the Chemical Society was born.

The Society was the first formed solely for the study of chemistry and although there were small private chemical societies before 1841 none lasted for any great length of time. At the first general meeting of the Chemical Society, Thomas Graham, the most distinguished chemist of his time, pioneer of colloid chemistry and a discoverer of much important new chemical knowledge, was elected the first president. The organiser of the meeting on February 23, 1841, was Robert Warington, who became the Society's first secretary. Graham and Warington were the leaders of the new organisation and among its present-day possessions one of the most valuable is the 100 year-old Obligation Book, which contains as its first signatures the names of those two pioneers. The book is still signed by new Fellows on their admission.

Offshoots from the Society

The Fellowship of the Society has grown from those 25 gentlemen in 1841 to more than 6000. The study of chemistry as a whole has remained its purpose; because of this the Society has always maintained a special place in the world of chemistry. It has not pursued the purely professional, nor has it specially fostered industrial chemistry, although many great industries have been based on fundamental discoveries made by its Fellows. The professional affairs of chemists are now the province of the Royal Institute of Chemistry (founded in 1877), and industrial chemistry is the concern of the Society of Chemical Industry (founded in 1881). Both these organisations were offshoots of the Chemical Society, as were other societies specialising in sub-divisions of the subject. To-day some of these offshoots, having meantime grown in stature and importance, are again joined with the parent body in the Chemical Council, which consists of representatives of various chemical organisations, and through which chemical industry and individuals subscribe to provide assistance in the publication of the results of chemical research and other information. Success has attended the Chemical Society from the first, and has been due almost entirely to the ready means it provides chemists of publishing their discoveries and affording them a place for discussion and mutual interchange of ideas. The Society has been the model and the elder sister of similar chemical societies set up in other countries, particularly Germany, France, and the U.S.A.

Distinguished Presidents

The science of chemistry has made great advances since 1841; a glance through the list of presidents of the society provides convincing evidence of the important part played by its Fellows, such as (to name but a few), Graham, Hofmann, Williamson, Edward Frankland, Odling, Gilbert, Sir William Perkin and W. H. Perkin, Crookes, Ramsay, Dewar, Armstrong, Meldola, and Pope, every one associated with fundamental chemical discoveries of far-reaching importance.

The discovery of mauve by Perkin is an example of the way in which the work of the research chemist may have a profound influence on social and economic development. From this early discovery has grown the whole of the present-day coal-tar industry, embracing dyestuffs manufacture, synthetic medicinals, the photographic industry, and much more. The pure research on the growth of plants by Gilbert and Lawes at Rothamsted formed the basis of the vast present-day synthetic fertiliser industry, the importance of which in the production of food needs no emphasis in a hungry world. Every day we can see evidence of the work of men like Crookes, Dewar, and Ramsay. The cathode-ray tube of Crookes is the direct ancestor of our television screens; the thermos flask of Dewar is one example of the application of Dewar's low-temperature experiments; and neon display signs are but one instance of the use man has made of Ramsay's epoch-making discovery of the rare gases.

With such a history, and with its present-day virility, the Society is clearly justified in planning to make the celebration of its centenary an important event. The importance was, indeed, internationally recognised in the decision taken in Rome, in 1938, by the International Union of Pure and Applied Chemistry, to hold its next international congress in London, at the time of the centenary of the Chemical Society. This decision is to be implemented next year and immediately following the celebrations on July 15-17 the Eleventh International Congress of Pure and Applied Chemistry will take place in London.

An international outlook has always been

characteristic of the Society and this will be reflected in the series of social and scientific events which will constitute the three days of celebrations. Many distinguished overseas delegates are to be invited. These will include the Honorary Fellows of the Society, among whom are the world's greatest chemists of to-day. If all those invited are able to attend, London will see in July, 1947, perhaps the greatest international gathering of chemists that has ever taken place. One of these distinguished visitors will be invited to follow in the line of Dumas, Cannizzaro, Wurtz, Mendeleef, Ostwald, Fischer, Richards, Arrhenius, Bohr, Debye, Rutherford, and Langmuir as the Society's Faraday Lecturer. The Faraday Lectureship was founded in 1867 to commemorate the name of Michael Faraday, who was elected a Fellow of the Society in 1842, and was one of its vice-presidents. In addition to the Faraday Lecture, it is intended that there should be a centenary ad dress and a formal ceremony for the presentation of addresses, as well as an exhibition at the Science Museum, etc.

Committees for the Occasion

The Chemical Society is already well forward in planning for the occasion and has enrolled some of its leading Fellows as an executive committee, which has put the arrangement of details in the hands of a number of sub-committees; the chairmen of these are indicated in the following list of the members of the executive, of which Prof. C. N. Hinshelwood, president of the Society, is chairman: Dr. M. P. Applebey, Mr. A. L. Bacharach (chairman of the Publicity Sub-Committee), Dr. G. M. Bennett, Dr. F. H. Carr, Prof. J. W. Cook, Dr. C. J. T. Cronshaw, Mr. F. P. Dunn (treasurer of the Society and chairman of Finance Sub-Committee), Sir Alfred Egerton, Prof. A. Findlay (chairman of Meetings, Entertainments and Social Functions Sub-Committee), Prof. C. S. Gibson, Prof. J. M. Gulland, Sir Ian Heilbron (chairman of Reception, Membership and Accommodation Sub-Committee), Lady Heilbron (chairman of Ladies' Sub-Committee), Prof. D. H. Hey (hon. secretary of the Society), Prof. E. L. Hirst, Prof. C. K. Ingold, Dr. L. H. Lampitt, Dr. R. P. Linstead, Prof. T. S. Moore (chairman of Centenary Volume Sub-Committee), Sir Robert Pickard, Mr. H. V. Potter, Mr. J. Davidson Pratt, Prof. E. K. Rideal, Sir Robert Robertson (chairman of Exhibition Sub-Committee), Sir Robert Robinson, Dr. F. Roffey, Prof. N. V. Sidgwick, Dr. J. L. Simonsen (hon. secretary of the Society), Prof. A. R. Todd, Prof. W. Wardlaw (hon. secretary of the Society), with Dr. D. C. Martin (general secretary of the Society), as secretary.

Swiss Chemical Industry

Further Company Reports

THE favourable picture which emerged from an analysis of the annual reports for the year 1945, issued by a number of well-known Swiss chemical companies (*see* THE CHEMICAL AGE, May 11) is, on the whole, confirmed by the results achieved by the remaining producers. F. Hoffmann-La Roche & Co., A.G., Lausanne, a firm of world-wide reputation, reports encouraging results for last year. The transport position has improved more quickly than was expected and regular supplies are again reaching territories closed to the company during the war. However, in spite of the general improvement, the supply position in basic products is by no means back to normal, and a number of important raw materials are in short supply. The policy of allowing the greatest freedom to foreign subsidiaries has yielded sound results, but considerable difficulties are being encountered in the transfer of profits. The company reports a gross profit of 17.10 million Swiss francs (17.49), and a net profit of 3.41 million francs (3.53). An unchanged dividend of 40.50 francs has been declared, to which has to be added a special anniversary distribution of the same amount.

Durand & Huguenin

Excellent financial results have been reported by Durand & Huguenin A.G., Basle, which, in spite of a temporary interruption owing to fuel difficulties, is again supplying a number of countries with its products, especially dyestuffs. In order to achieve greater independence, the production of certain basic materials has been taken up by the firm, necessitating the construction of new plant. Profits have doubled from 423,888 Swiss francs in 1944 to 858,930 last year, and a dividend of 10 per cent. (5 per cent.) has been declared. Both pension and social funds have been increased.

Lonza

The Lonza Elektrizitätswerke und Chemische Fabriken A.G., Basle, while confident about developments in the immediate future, issues a reminder that most industrial nations have increased their chemical production capacity, which might lead to a decline of Swiss exports. Domestic demand, especially for nitrogen fertiliser, has been fully met, but the coal shortage made it impossible to seize all the available export opportunities. Negotiations have been initiated with the Allied authorities about the company's plants in Germany, but no results have as yet been made public. Gross profits amount to 13.25 million Swiss francs (13.32), and out of the net profit of 4.28 million francs (4.54), an unchanged dividend of 6 per cent. has been declared.

Oil and Colour Chemists' Association

Annual General Meeting

THE annual general meeting of the Oil and Colour Chemists' Association was held at the Grand Hotel, Birmingham, on July 12, with the President, Dr. H. W. Keenan, in the chair.

Mr. F. Fancutt, moving the adoption of the annual report of the Council for 1945-46, commented that the account of the Association's activities was impressive, and there was no doubt that in many directions the Association was moving on the right lines. The work started by way of co-operative research was a very fine gesture, and it would grow. The Council as a whole were very conscious of the whole-hearted effort of Mr. S. G. Tinsley in that connection.

The president paid warm tributes to members who had given a great deal of work and time to the Association, mentioning particularly Mr. A. H. Whitaker, hon. secretary, Scottish Section; Mr. G. N. Hill, the association's hon. editor, who felt that he should retire from that office; Mr. George Copping, Dr. L. A. Jordan, and Mr. P. J. Gay, who were retiring from the Council; Mr. W. P. Jenkins, chairman of the Newcastle Section; and Mr. H. Clayton, who had served as vice-president.

Amendments to Rules

The meeting agreed to an alteration of rule, providing that junior membership be restricted to persons under the age of 18 years, instead of 21 years, as previously.

One of the proposed amendments to the rules approved by the council, in accordance with a resolution passed at the previous annual general meeting, provided that the council should consist of: the president; not more than five vice-presidents; the chairmen of local sections; six members elected by the whole Association, irrespective of the number of sections; five honorary officers (the immediate past president, the hon. editor, the hon. research and development officer, the hon. secretary and the hon. treasurer). The effect of this is to halve the number of council representatives elected by the sections. After a long discussion, the amendment was adopted, it being felt that the council was unwieldy, and that the amendment enabled the number to be reduced with equity.

Another proposal discussed at some length related to subscriptions. The present subscription is £1 1s. a year for ordinary and associate members, and 10s. 6d. for juniors. The proposal was that ordinary and associate members should pay £1 1s. a year up to the age of 25, and £2 when 25 years and over; juniors to pay 5s. a year. Eventually it was agreed that before the amount of the increase is decided, the council should present a financial statement showing estimated expenditure.

Officers were elected for the ensuing year as follows: *President,* Dr. H. W. Keenan (re-elected); *vice-presidents*: Mr. N. A. Bennett, Mr. J. Crombie, Mr. C. A. F. Hastilow, Mr. C. A. Klein, Mr. W. G. Wade; *hon. secretary,* Mr. A. J. Gibson; *hon. treasurer.* Mr. G. W. Read-Baker; *hon. editor.* Dr. R. F. Bowles; *hon. research and development officer,* Mr. S. G. Tinsley. *Section chairmen who will serve on the Council*: Mr. V. C. Thompson (Bristol), Mr. W. Geary (Hull), Mr. R. J. Ledwith (London), Dr. J. J. Sleightholme (Manchester), Mr. W. P. Jenkins (Newcastle), Mr. F. G. Adams (Overseas—New South Wales), Mr. J. V. Crossley (Scottish).

The following were elected to the Council by the free vote of the Association: Mr. E. J. Bond, Mr. F. Fancutt, Mr. H. Gosling, Mr. D. H. Hewitt, Mr. G. F. Holdcroft, Mr. H. A. Idle.

Liaison Council Proposed

The president referred to his recent visit to America, the purpose of which was to effect an alliance between the technical men of America, Canada, and Great Britain, and, having effected a link-up much earlier with Australia, to arrange for undertaking co-operative research between the four countries. He said it was proposed to form a Liaison Council, consisting of three members of O.C.C.A. and three members of the Federation of Paint and Varnish Production Clubs, U.S.A., and he hoped the New South Wales Section of O.C.C.A. would also have three members. The Liaison Council would be the chief channel through which an effective alliance could be brought about. The whole project had excited immense interest in America. There would be arrangements for a voluntary exchange of literature. It was hoped that members proposing to visit one of the countries mentioned would inform the Liaison Council of their intention so that arrangements could be made for them to receive every possible assistance.

On the council's recommendation, the meeting unanimously agreed that Dr J. J. Mattiello, of U.S.A., be elected an hon. member of the association, in recognition of his outstandiing services to the technical men of both our countries.

Ceylon mineralogists are carrying out surveys of thorium deposits which have recently been discovered in that country.

Personal Notes

At St. Andrews University, DR. H. T. OPENSHAW has been appointed Purdie Lecturer in Chemistry, and MR. F. CHAPMAN, Lecturer in Chemistry, both at United College.

CAPT. F. J. E. CHINA, O.B.E., B.Sc., F.R.I.C., has become chairman of Messrs. Burt, Boulton & Haywood on the resignation of Mr. C. H. Haywood, who is remaining on the board.

MR. PHILIP THOMAS, chemist in the research laboratory at the National Smelting Company's Avonmouth works, Bristol, has won a Leverhulme studentship in Chemical Engineering. The studentship, which is valued at £250, is tenable at University College, London, for a year.

MR. W. MORGAN THOMPSON, who joined Monsanto Chemicals, Ltd., in 1933, as a sales representative, and served throughout the war as an officer in the Army, has been appointed home sales manager under Mr A. D. Daysh as sales director, and Mr. D. R. Mackie as general sales manager.

ADMIRAL SIR LIONEL PRESTON has resigned from the chairmanship and managing directorship of Titanine, Ltd., and remains a director. MR. A. FLETCHER, who has been a director since 1943, has been appointed chairman. MR. G. W. R. WARD has been appointed managing director, and MR. W. E. ROBINSON an additional director.

DR. W. A. ARCHIBALD, who has been appointed head of the refractories section of the chemistry department of the British Iron and Steel Research Association, has been with General Refractories, Ltd., Glasgow, for the past seven years. He previously carried out research on steel slag refractories problems at the Royal Technical College, Glasgow.

MR. H. F. SCHOFIELD, A.R.I.C., manager of the Manchester office of the Witco Chemical Co., Ltd., since its inception in 1943, has now become a director of the company. After graduating from Manchester College of Technology, he did research work into accelerators and anti-oxidants under Dr. W. J. S. Naunton and spent a short time in America before joining the Witco organisation in 1929.

MR F. BOWER, of Lever Bros. and Unilever, Ltd., and MR. L. P. O'BRIEN, of the Association of British Chemical Manufacturers, are among members of a Federation of British Industries delegation, which, at the invitation of the Federation of Belgian Industries, is now in Brussels to continue discussions of general industrial and commercial interest, begun when representative Belgian industrialists visited England in January.

Electrodepositors

Technical Society's New Officers

THE results of the recent election of officers and members of council of the Electrodepositors' Technical Society for the 1946-47 session are as indicated below:

President, Dr. S. Wernick, Ph.D., M Sc.; *Immediate Past-president,* Dr. J. R. I. Hepburn, D.Sc., Ph.D., F.R.I.C.; *Vice-presidents*: Dr. H. J. T. Ellingham, Ph.D., A.R.C.S., A.M.I.Chem.E., F.R.I.C.; Dr. G. E. Gardam, Ph.D., A.R.C.S., F.R.I.C.; Mr. F. L. James; *Honorary Treasurer,* Mr. F. L. James; *Deputy Hon. Treasurer,* Mr. S. W. Baier. *Council*: Dr. J. E. Garside, Ph.D., M.Sc.Tech.; Mr. R. A. F. Hammond, B.Sc., A.R.C.S.; Mr. H. Silman, B.Sc., F.R.I.C., A.M.I.Chem.E.; Mr. A. Smart, B.Sc.; Mr. A. W. Wallbank, B.Sc. *Faraday Society Representative,* Dr. A. Hickling. *Ex-officio Members*: Mr. N. A. Tope (chairman, Midlands Centre), Mr. R. C. Davies (hon. secretary, Midlands Centre), Mr. E. A. Ollard, A.R.C.S., F.R.I.C. (hon. secretary, Standards Committee).

B.A.C. CHANGES

As a result of recent annual general meetings, both at headquarters and in the local sections, a number of changes among the hard-working officials of the B.A.C. fall to be recorded. At headquarters, MR. NORMAN SHELDON, hitherto hon. sec. of the London section, becomes vice-chairman in place of Mr. J. W. Fisher, and MR. H. L. HOWARD succeeds Dr. F. W. Stoyle as hon. registrar. MR. D. JACKSON is the new chairman of the London section, in place of Mr. E. Leighton Holmes, while MR. W. T. HERBERT takes over from Mr. Sheldon as hon. secretary.

At Liverpool, MR. E. MYER replaces Mr. E. Finklestone as hon. sec. and similar changes have occurred in the secretaryship of three other sections. At Derby, MR. J. A. HAWKES succeeds Mr. G. Bingham; in the North-East, MR. G. GARBUTT replaces Mr. S. A. Polaine; and in Yorkshire MR. G H. GOSSOP follows Mr. R. Marsh.

In the new Slough section, which held its first annual meeting in May, MR. L. L. PEARSON was re-elected chairman, and MR. R. F. BIRD became hon. secretary.

In the ruins of a store shed in the Krupp works at Essen, ¾ ton of uranium ore has been discovered by British authorities after some considerable search. It was known that Krupps had been using uranium oxide in experimental work on hard steel manufacture. The ore, confiscated under the relevant clause of the Potsdam agreement, has now been shipped to Britain.

Parliamentary Topics

Government-Owned Steelworks

IN the House of Commons last week, Mr. Langford-Holt asked the Minister of Supply what was the total amount of capital moneys invested by the Government in the Government-owned steelworks at Monkbridge, Leeds, and Barrow-in-Furness; and whether he would publish the trading results of those two works up to March 31 last.

Mr. Wilmot replied that the total capital expenditure was £724,000 at the Barrow works, and £522,000 at the Monkbridge works. The operation of the Barrow works resulted in a net loss of £779,000 from November 1, 1942, to March 31 last; and of the Monkbridge works in a net loss of £180,000 from August 10, 1942, to March 31 last. Production from the two works was needed for national requirements, but they were uneconomic producers and would not normally have been kept in operation. The Government acquired ownership to maintain production and since that time output had been satisfactory. The trading losses were less than would have been the cost of importing an equivalent quantity of steel.

Penicillin

Mr. Wilmot, in reply to questions by Sir John Mellor, said penicillin supplies were steadily increasing, but it would not be possible for some time to estimate the demand accurately. He would consider the desirability of discontinuing control immediately it was apparent that supplies were sufficient to meet an uncontrolled demand.

Atomic Energy

Mr. Blackburn asked the Minister of Supply whether he would make a statement as to the progress made either in Britain or Canada with the production of radium and of radio-active isotopes as by-products of atomic energy.

Mr. Wilmot pointed out that radium was not produced as a by-product of atomic energy, but stated that an atomic energy "pile," capable of producing radio-active isotopes, was nearing completion in Canada, and some of its products would be distributed to recognised institutions in the U.K. Production of radio-active isotopes would begin in this country on completion of the "piles" now under construction. In reply to a further question, Mr. Wilmot repeated "quite categorically" that the danger to surrounding areas from the Atomic Energy Research Establishment was negligible.

Use of Magnesium Factories

Answering questions by Mr. Awbery, Mr. Wilmot stated: "Three factories, erected at Government expense during the war, have ceased the production of magnesium as, with the end of the war, the demand has fallen very steeply. The first, erected at a cost of £990,000, is surplus to requirements and has been transferred to the Ministry of Works for temporary house production, pending a decision as to its final use. The second, erected at a cost of £4,350,000, has been placed on a care and maintenance basis as standby capacity, and is being used for storage. The third was only partly employed on magnesium production, expenditure on magnesium capacity being £760,000. The entire factory has been notified as surplus, to the Board of Trade." In reply to a further question, Mr. Wilmot said the demand for magnesium during the war was 100,000 tons a year, but it was now less than 2500 tons, most of which could be obtained from scrap. It was impossible to destroy the capacity to produce magnesium.

Ground-nuts

The Minister of Food, replying to a question by Mr. Driberg, stated that the quantity of ground-nuts shipped from the Port of Madras and the other usual Coromandel coast ports to the U.K. so far this year was 40,865 tons. Further supplies could not be expected as long as the present prohibition continued on the export of ground-nuts from India. The tonnage originally expected for the whole of 1946 was 250,000 tons.

Oil Seeds

In answer to questions by Sir R. Glyn, the Minister of Food said he did not feel it would be in the public interest to publish figures giving the present stock position of oil seeds in the U.K. Supplies were based on the recommendations of the International Emergency Food Council, on which the U.K. was represented. All possible measures were being taken to ensure the largest possible supplies for this country.

Palm Oil

The Minister of Food, replying to a question by Sir D. Thomson, stated that the Ministry had purchased for some time ahead the entire production of palm oil from the principal estates in Malaya, and he was hoping to obtain a substantial part of the production of the few estates which were outside the main group.

Phenolic Moulding Powders

Mr. Belcher, in reply to a question by Sir I. Fraser, said the supply of phenolic moulding powders was now considerably greater than it was before or during the war, but no further substantial increase could be expected until additional manufacturing capacity came into operation towards the end of the year.

General News—From Week to Week

The National Coal Board assumed office as from July 15, but it does not take over the industry until "the vesting date," to be fixed by the Minister of Fuel later.

"The Operation of Gas Producers" is the title of the latest Fuel Efficiency Bulletin—No. 44—free copies of which are obtainable from the Ministry of Fuel.

The Widnes copper refining firm of Thomas Bolton & Sons, Ltd., has acquired Hales Hall, near Froghall Works, Widnes, as a hostel for technical trainees and junior technicians.

The Council of the Society of Chemical Industry has approved the publication of a monthly journal, *The Journal of the Science of Food and Agriculture,* as soon as paper supplies permit.

From Dublin comes news that a bill has been introduced into the Dail creating a new Institute for Industrial Research and Standards. It will replace the existing Industrial Research Council.

Now is suggested as a suitable time for a thorough overhaul of all fuel-using plant. The Ministry of Fuel free Bulletin No. 38, "Maintenance of Industrial Plant," will help in planning the work.

A conference on exports is to be held under the auspices of the F.B.I. at the Central Hall, Westminster, London, on November 27-28, when practical problems that face industry in the export drive will be defined and discussed.

A marked increase in the use of lime by Scottish farmers is shown in returns for the latter half of 1945 and the first quarter of 1946. Scottish producers of the higher grades of lime, although working to full capacity, have had difficulty in meeting the demand.

New D.T.D. Specifications, obtainable from H.M. Stationery Office at the prices stated, have been issued by the Ministry of Supply as follows: 495, "Calcium Chromate (for Corrosion Inhibitor Cartridges)," 6d.; 911a, "Protection of Magnesium-Rich Alloys against Corrosion" (superseding D.T.D. 911), 1s.

After nearly 57 years in their previous premises at Landore, Swansea, T. Dryden, chemical laboratory furnishers, have now removed into new and more commodious premises, at one time occupied by the Landore Cinema, 201 Neath Road, Landore. The former operating and film rooms now serve conveniently as offices, while the large hall is fitted out with modern shelving and racking. The acid department has been kept entirely separate.

I.C. (Pharmaceuticals), Ltd., have moved their offices from 89 Oxford Street, Manchester, 1, to "The Ridge," Beechfield Road, Alderley Edge, Manchester. The new telephone number is Alderley Edge 2231, but that of the distribution department is still Central 0387.

A large factory, which was erected by the Ministry of Supply at Barcaldine (between Oban and Ballachulish) during the war, and has been closed for about two years, has been re-opened by the Scottish Seaweed Research Association for the manufacture of chemicals and other products from seaweed.

Wholesale prices in June, measured by the Board of Trade index number, rose by 0.3 per cent. compared with May, due mainly to the increase in the price of raw cotton and cotton goods. In the chemicals and oils group the increase was 0.1 per cent. compared with May, and 54.2 per cent. compared with 1938.

The Ruabon works of Monsanto Chemicals, Ltd., are to be closed completely from August 3-13 inclusive so that major maintenance work can be carried out after seven years of continuous production, most of it 24 hours a day, seven days a week. A skeleton despatch service will deal with urgent requirements.

The Chemical Society will hold an extraordinary general meeting in the Society's Rooms, Burlington House, W.1, on July 25, at 3 p.m., to confirm the following proposal of the Council: "That as from January 1, 1947, the amount of the annual subscription be increased from £3 to £3 10s., and that a corresponding increase be made in the amount of the life composition fee."

A further cut in the volume of linseed oil available to the Scottish linoleum industry is foreshadowed in reports from Kirkcaldy, chief centre of this industry. Hopes that the industry might obtain sardine oil, which has been proved a satisfactory substitute for linseed oil in linoleum manufacture, have been discouraged by failure to obtain import licences.

More than 100 industrial chemists, mostly members of the Liverpool and North-Western Section of the Royal Institute of Chemistry, were entertained to a dinner and social evening at Liverpool to mark the opening of a refresher course which the section has organised in conjunction with Liverpool University. The course is divided into two parts: one for oils and fats, in charge of Professor Hilditch (Professor of Industrial Chemistry at the University), and the other for spectroscopy, in charge of Professor Morton (Professor of Biochemistry).

The foundation stone of the new office building of Tate & Lyle, Ltd., at their Plaistow Wharf sugar refinery, was laid on July 12, by Lord Lyle of Westbourne, who used the same silver trowel as his grandfather used at the foundation of the original buildings at Victoria Docks. The new office building is to replace the miscellaneous premises in which the offices were housed until destroyed by enemy action in 1940.

Foreign News

The Hermann Göring works in Linz—now called the United Iron & Steel Works—were handed over to the Austrian Government on Tuesday by the Americans.

Eight chemists are included among 30 technicians for whom arrangements have been made, at the request of the Government of India, to join British and American experts who are to investigate German technical and industrial processes likely to be advantageous to Allied industrial production.

The National Research Council of Canada earned $4,360,997 during the six years ended April 1 as payment for its services to private industry and other enterprises, according to a statement made by the Hon. C. D. Howe, Minister of Reconstruction, in the Canadian House of Commons.

The sale of the British-owned Indian firm of Govan Brothers, Ltd., to a Marhwari industrialist, Mr. S. R. Dalmia, announced last week by the Delhi correspondent of *The Times* involves also the chemical manufacturing works of Dharangadhra Chemicals, which is to retain its identity.

China's tung oil production, which before the war occupied an unrivalled position in world markets, and reached an average annual output of 9000 tons, has, as a result of eight years of warfare, dwindled to about one-quarter of this figure. Owing to the soaring price of foodstuffs, farmers have in recent years planted cereals instead of tung seeds.

A leave scheme, whereby industrial scientists in its employ will be enabled to return to universities of their choice for an academic year of study at full salary, has been inaugurated by the Monsanto Chemical Co., of America. Leave will be granted on the basis of especially meritorious service and outstanding performance in scientific work.

U.S. output of metal powder has kept up its war-time peak of about 200 million lb. annually; heavy demand is expected from chemical and electrical companies. Great progress has been made in the production of iron powder, which was formerly bought from Sweden but is now made in America, and will probably be considerably lower in price than the present figure of $250 a ton.

The American Standards Association has announced publication of its 1945-46 Year Book, the first issue since 1938, and therefore containing much new material. Copies of the Year Book may be obtained free of charge on writing to the American Standards Association, 70 East 45th Street, New York 17, N.Y.

Among the Indian industries for which nationalisation is considered desirable, according to an official article in the current issue of the *Board of Trade Journal*, are: heavy and fine chemicals, chemical dyes, fertilisers and pharmaceutical drugs; chemical machinery; electro-chemical industry; sugar; non-ferrous metals; iron and steel; rubber manufacture.

A patent recently granted to Du Ponts in the U.S. names ammonium nitrate in liquid anhydrous ammonia as a fuel for internal combustion engines, and, since ammonium nitrate contains oxygen which can be easily liberated and then immediately combined with the other elements, an engine using such fuel would need no outside source of oxygen; and it would be "non-fouling," since carbon would not be deposited from the fuel.

A message from Montreal states that the National Drug & Chemical Co., has called a special meeting of shareholders for August 7 to consider arrangements to reorganise the share capital. According to a statement by the president, Mr. C. H. Lander, the control of the company was held for many years by preference shareholders residing in England, from whom recently over 90 per cent. of the preference shares has been acquired by Canadian interests, with a result that voting control now rests in Canada.

A World Conference on Mineral Resources will be held in the United States in connection with official observance of the 75th Anniversary of the American Institute of Mining and Metallurgical Engineers on September 16-18. Every phase of the world's situation with respect to ferrous and non-ferrous metals, coal, petroleum, and other important industrial minerals will be covered, and Mr. Herbert Hoover, a past-president of the Institute, will be hon. chairman.

What is considered to be one of the world's richest molybdenum mines is situated in Yangchiahangtzu, 25 miles north of Hulutao in Liaotung Bay. Lead and zinc ores found in the deposit have been exploited since 1935 by the Japanese - controlled Manchurian Heavy Industries Company. Molybdenum was not discovered until 1939, when the Japanese estimated the ore reserves at about 8,000,000 tons, with a metal content of 40 per cent. However, the mines cannot at present be exploited because most of the equipment has been removed by Russia.

Company News

Yorkshire Copper Works, Ltd., are again paying an ordinary dividend of 10 per cent., plus bonus of 5 per cent. Profit for 1945 amounted to £78,768, against £71,155 for 1944.

The report of **Lovering China Clays, Ltd.**, for the year ended March 31 shows net profit of £6101, as compared with £2516. This reduces the debit balance to £16,914, which is carried forward.

Net profit of £24,356 for 1945 is shown by the **Permutit Co., Ltd.**, this comparing with the previous year's figure of £20,662. The ordinary dividend of 10 per cent. and bonus of 2½ per cent. are the same as before.

British Timken, Ltd., have now published accounts for 1945, showing net profit of £70,360. This includes £10,000 dividend from subsidiary and compares with £52,624 for the previous year. The dividend of 15 per cent. is the same as previously.

An increase in ordinary dividend from 10 per cent. to 15 per cent. is announced by **British Glues & Chemicals, Ltd.** Profit for the year to April 30 last amounted to £109,384, as compared with £101,725 the previous year.

The Distillers Co., Ltd., report that the group's manufacturing and trading profits to May 15 last totalled £6,914,290, after E.P.T. and overseas taxation, this figure comparing with £6,581,330 for the previous year. The total ordinary distribution is up by 2½ per cent. to 22½ per cent.

Chloride Electrical Storage Co., Ltd., is paying bonus of 10 per cent. (including 5 per cent. victory bonus) in addition to the final ordinary dividend of 5 per cent., making 20 per cent. for the year ended March 31 last, as against 15 per cent. for the previous year. Profit amounted to £486,928 (£426,033).

British Drug Houses, Ltd., has been granted permission to deal in 175,000 5 per cent. cumulative preference shares of £1 each and 200,000 ordinary shares of £1 each. Preference shares are offered to holders at 24s. in the proportion of one new for every two held, while the ordinary shares are offered to existing holders at 50s. in the same proportion.

An issue to shareholders will shortly be made by **British Industrial Plastics, Ltd.** It is proposed to issue new 2s. ordinary shares to existing holders in the proportion of two new for every seven ordinary held. The issue has been guaranteed by British Shareholders Trust. The present issued capital of the company consists of £14,820 in 10 per cent. free of tax cumulative preference shares of 2s. and £429,891 10s. in 2s. ordinary shares.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

INTERNATIONAL CORRODELESS, LTD., Enfield, proprietors of patent for treating metals for their preservation from corrosion. (M., 20/7/46.) June 11, debenture to Lloyds Bank, Ltd., securing all moneys due or to become due to the Bank; general charge. *Nil. February 28, 1946.

SURREY COPPER CO., LTD., Surbiton. (M., 20/7/46.) June 12, £2300 (not ex.) and £800 (not ex.) mortgages to Lloyds Bank, Ltd.; respectively charged on 70, 72, 74 and 76 King Charles Road, and on land at rear of 24, 25, 26, 27, 27a, 28 and 29 Alpha Road, Surbiton. *Nil. December 14, 1945.

Satisfaction

UNION GLUE & GELATINE CO., LTD., (formerly British American Glue & Gelatine Co., Ltd.), London, E.C. (M.S., 20/7/46.) Satisfaction June 24, of charge registered August 25, 1945.

Companies Winding-Up Voluntarily

MARVOS CHEMICAL MANUFACTURING CO. (LUTON), LTD. (C.W.U.V., 20/7/46.) By special resolution, July 2. N. G. Randall, of A. A. Henley & Co., 19-20 Grosvenor Place, London, S.W.1, appointed liquidator.

Chemical and Allied Stocks and Shares

HELPED by the U.S. loan and the strength of British Funds, stock markets were firm, small gains ruling in most sections, although generally there was only a moderate increase in the volume of business. Argentine rails remained prominently active, but home rails lost part of earlier rise.

Shares of chemical and kindred companies have been firm in accordance with the general tendency, attention being centred mainly on shares of concerns with important connections both in home and export trade. Imperial Chemical strengthened to 43s. 6d., Turner & Newall rose to 93s., Lever & Unilever to 57s., and United Molasses to 57s. 3d.

Borax Consolidated showed firmness at 48s. 9d., B. Laporte were maintained at 100s., while on satisfaction with the new issue terms, British Drug Houses were 61s. 3d. ex rights to the new shares, with the latter at 10s. 6d. premium. Reflecting further consideration of the results, British Glues 4s. ordinary held their rise to 15s. 7½d. xd, while Imperial Smelting were better at 19s. 6d., and a rise to 22s. 3d. in Amalgamated Metal shares was attributed to hopes that the London Metal Exchange may be re-opened this year. General Refractories were 23s. 1½d., but Dunlop Rubber at 74s. 9d. lost part of an earlier rise. British Match 50s., British Oxygen 102s. 6d., British Aluminium 43s., and British Plaster Board 36s. 3d. have been firm, the last-named on the full results. Cement shares were strong on the belief that the industry can expect increasing demand for a long time to come; Associated Cement rose to 72s. 6d., Tunnel Cement to 50s. 6d., and Rugby Cement 5s. shares to 15s. 3d.

Iron, coal and steels continued to show a better tendency, on the view that current prices may prove under-valuations, despite nationalisation uncertainties, Stewarts & Lloyds moved up to 50s. 3d., while United Steel hardened to 22s. 10½d., and Guest Keen to 40s. 9d. Powell Duffryn improved to 22s. 4½d. on the full report, and a further sharp rise to 36s. 6d. was shown in Shipley. Staveley were also higher at 46s. 6d., and T. W. Ward were 44s. 6d.

Courtaulds have been active around 57s. 6d., with British Celanese 38s., and textiles generally firm, Bleachers further improving to 14s. 9d. in anticipation of the forthcoming capital scheme. De La Rue were £12¾, British Xylonite changed hands up to £7 15/16, Erinoid were 16s., and the recently introduced 2s. shares of O. & M Kleemann advanced further to 41s. British Industrial Plastics 2s. shares eased slightly to 5s. 7½d., awaiting terms of the company's new share issue. In other directions, British Tar Products rose further to 14s. 3d., British Lead Mills were 12s. 9d., Lawes Chemical 13s. 3d., and Monsanto Chemicals 5½ per cent. preference marked 24s. 6d. Greeff-Chemicals Holdings 5s. ordinary changed hands around 13s. 3d., Burt Boulton were 27s. 6d., Fisons 62s. 6d., Goodlass Wall 32s., and United Glass Bottle 91s. 6d., Triplex Glass fell back to 40s. at one time, but later rallied to 42s. 6d.

Boots Drug at 63s. remained under the influence of the full results. Timothy Whites rose to 46s. 9d. Sangers were 34s., Griffiths Hughes 60s., and Beechams deferred have been active around 27s. 3d. Ruston & Hornsby were 60s. 9d. "ex rights," the new shares being 5s. premium. Swedish shares were marked higher on the revaluation of the krona, Swedish Match being 41s. 3d., a rise of 4s. 9d. Oil shares were unresponsive to the forthcoming increase in the petrol "ration," although most of the leaders were higher on balance, Shell being 95s. 7½d., but, reflecting the latest news from Persia, Anglo-Iranian declined to 99s. 4½d.

British Chemical Prices

Market Reports

STEADY trading conditions have again been reported on the London chemical market, more especially with regard to contract specifications. New business has been in evidence and the export demand has been unabated, though in nearly all directions prompt deliveries are difficult to secure. Permanganate of potash is in good call and a ready market awaits offers of bichromate of potash. In the soda products section chlorate of soda, yellow prussiate of soda, and the sulphides are firm on a strong request, while a steady movement is reported for both the photographic and technical grades of hyposulphite of soda. The coal-tar products market continues firm, with the demand generally in excess of available supplies. Pitch has again been active, and the export inquiry for cresylic acid has been maintained.

MANCHESTER.—Marked firmness continues to characterise most sections of the Manchester market for heavy chemicals, and the recent sharp rises in the non-ferrous metal compounds appear to have had little restrictive effect on the volume of business. The movement of textile bleaching, dyeing, and finishing chemicals against contracts has been affected to a slight extent by industrial holidays in cotton towns, but, on the whole, consumption has been on steady lines, and a fair flow of new inquiries from home users has been in the market. Export buyers have also been fairly prominent. In the leading tar products fairly active trading conditions have been reported and some new shipping business has been arranged.

GLASGOW.—With the approach of the Glasgow Fair holidays, the demand for general chemicals for the home trade had a tendency to ease off towards the end of last week. Prices remained firm all round, with increase in value of oxalic acid and acetates. The export market is still occupied with arrears of orders, and more inquiries have been coming in.

Price Changes

Copper Carbonate.—MANCHESTER: £8 15s. per cent.

Lead Nitrate.—MANCHESTER: £55.

Sodium Sulphide. — Broken, 60/62%, £20 2s. 6d. per ton; flake, 60/62%, £21 17s. 6d. per ton; crystals, 30/32%, £13 7s. 6d. per ton. Carriage paid U.K. stations, in 1-ton lots.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given unded "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Rolling of metals.—M. Fairest, Ltd., M. Fairest, and H. Akers. 17348.

Rotary kilns.—J. S. Fasting. 17979.

Silica hydrosol.—J. G. Fife. (Davison Chemical Corporation.) 17478.

Die-casting machines.—C. G. Garrard. 18164.

Liquid dispensing.—Gaskell & Chambers, Ltd., and J. S. Weightman. 17882.

Water softening.—Gas Light & Coke Co., R. P Donnelly, F. E. Mills, and W. R. Dudden. 17748.

Fibre dyeing.—J. R. Geigy A.G. 17383.

Insecticides.—J. R. Geigy A.G. 18075.

Reclaiming plastic scrap.—Gem Participations, Inc. 17584.

Silver halide emulsions.—N.V. Gevaert Photo-Producten. 17596.

Methine dyestuffs.—N.V. Gevaert Photo-Producten, and J. Beersmans. 18126.

Chemical percentage indicators.—T. W. Gilmour. 17368.

Liquid atomisers.—S. Gimelli. 17762.

Zinc-containing materials.—Glacier Metal Co., Ltd., and W. H. Tait. 17959.

Emulsifying plants.—R. C. Glaze. 17947.

Stroboscopic tachometers.—J. Gudgeon. 17551.

Liquid-dispensing apparatus.—G. Morgan-Harris. 17505.

Ferrous alloys.—Haynes Stellite Co. 17841-50.

Electrotherapeutic baths.—J. Heller. 18100-1.

Detergents.—F. W. Kay. 17343.

Fluoro-chloro compounds. — Kinetic Chemicals, Inc. 17707-8.

Liquid dispensing.—W. van Leer. 17665.

Tin-plating solutions.—London Chemical Products, H. Stern, and B. Gluck. 18081.

Alloys. — Mathieson Alkali Works. 17805-6-7.

Chemical compounds.—Merck & Co., Inc. 17671-2-3.

Electrode holders.—A. Middleton. 17930.

Liquid dispensing.—F. W. Milwain, and W. Evans. 17880-1.

Dispensing devices.—T. A. Mulhearn. 18025.

Liquid-dispensing devices.—W. V. Myers Co., Ltd., and W. V. Myers. 17822.

Liquid measuring apparatus.—N.V. Philips Gloeilampenfabrieken. 18035.

Starches.—N.V. W. A. Scholten's Chemisce Fabrieken. 17604.

Plastic material.—C. Nicolle. 17718.

Azo compounds.—Norsk Hydro-Elektrisk Kvaelstof A/S. 17816.

Waxed polish.—G. R. Palmer. 17831.

Aerial spraying.—Pest Control, Ltd., and P. W. Tudor. 17812.

Aerial spraying.—Pest Control, Ltd., W. E. Ripper, A. K. Dorman, E. J. Marshall, and P. W. Tudor. 17813.

Olefines.—Phillips Petroleum Co. 17405

Testing of colour extracts.—A. Pilny. 18191-2.

Treatment of glyceride oils.—Pittsburgh Plate Glass Co. 17904.

Connecting devices.—Plastic Housing (Patents), Ltd., and I. Shamah. 17818-9.

Fluid flow control apparatus.—R. Poole. 17492.

Fluid flow meters.—R. Poole. 17929.

Fluid compressors.—C. A. Pugh, L. A. Darby, and Plessey Co., Ltd. 17709.

Metal coatings.—Pyrene Co., Ltd. (Parker Rust-Proof Co.) 17792.

Pyridine.—Pyridium Corporation. 17482-3, 17486.

Pyridium compounds.—Roche Products, Ltd. 17814.

Fluid-separating means.—Shell Development Co. 17476.

Fertilisers.—R. E. Slade. 18092.

Benzene hexachloride.—Solvay & Cie. 18016.

Aluminium-silicon alloys.—Spolik pro Chemickou a Hutni Vyrobu. 17582.

Styrene compositions.—Standard Telephones & Cables, Ltd. 18007.

Complete Specifications Open to Public Inspection

Continuous electrodes for electric furnaces.—Norsk A/S for Elektrokemisk Industri. July 13, 1939. 13098/46.

Hydrolysis of acetone auto-condensation products.—Shell Development Co. Dec. 5, 1944. 28783/45.

Treatment of materials with gases.—A/S F. L. Smidth & Co. Dec. 8, 1944. 6478/46.

Bleaching of fibres.—Solvay & Cie. Dec. 15, 1944. 32483/45.

Catalytic isomerisation processes and reformed catalysts therefor.—Standard Oil Development Co. Sept. 13, 1941. 9409/42.

Synthesis of hydrocarbons.—Standard Oil Development Co. Dec. 14, 1944. 15489/45.

Lubricants.—Standard Oil Development Co. April 17, 1941. 19711-2/45.

Synthesis of hydrocarbons.—Standard Oil Development Co. Dec. 16, 1944. 22298/45.

Treatment of vinyl chloride-vinylidene chloride copolymers.—Wingfoot Corporation. June 11, 1943. 20641/43.

Bactericides.—A/S Niro Atomiser. Dec. 18, 1944. 11634/46.

Recovery of metallic magnesium from its ores.—Aluminium Co. of America. June 29, 1944. 13780/46.

Cellulose derivative compositions.—British Celanese, Ltd. Dec. 21, 1944. (Cognate application 34768/45.) 34767/45.

Cellulose ether compositions. — British Celanese, Ltd. Dec. 21, 1944. 34770/45.

Dimethyl silicon compositions.—British Thomson-Houston Co., Ltd. Dec. 23, 1944. 34220/45.

Stable supersaturated solutions of saccharide derivatives of compounds of the suprarenal cortex hormone series.—Ciba, Ltd. Dec. 22, 1944. (Cognate application 33487/45.) 33486/45.

Azo-dyestuffs.—Ciba, Ltd. Dec. 19, 1944. (Cognate applications 34269-70/45.) 34268/45.

Utilising liquefied fuel gases. — Cie. Française de Raffinage. May 18, 1942. 14088/46.

Alkylation processes.—Cie. Française de Raffinage. Nov. 17, 1942. 14206/46.

Continuous catalysis.—Cie. Française de Raffinage. May 8, 1943. 14208/46.

Hydrocarbon storage tank with strengthened roof.—C. Couvy (née Piron). Dec. 19, 1944. (Cognate application 9837/46.) 9836/46.

Rendering liquids nebulous.—A. Denier. Dec. 19, 1944. 34183/45.

Low carbon metal alloys and the like.—Det Norske A/S for Elektrokemisk Industri. Aug. 18, 1943. 13930/46.

Polymers and interpolymers of ethylene.—E. I. Du Pont de Nemours & Co. April 9, 1940. 4729/41.

Polymerisation of olefinic compounds.—E. I. Du Pont de Nemours & Co. March 15, 1941. 12118/41.

Ethylene polymerisation processes.—E. I. Du Pont de Nemours & Co. July 30, 1942. 12402/43.

Solid and semi-solid polymers from aliphatic mono-olefines.—E. I. Du Pont de Nemours & Co. Dec. 3, 1942. 20214/43.

Polymerisation of olefines.—E. I. Du Pont de Nemours & Co. Dec. 9, 1942. 20501/43.

Polymers and interpolymers of ethylene.—E. I. Du Pont de Nemours & Co. March 4, 1943. 3986/44.

Organic nitro compounds.—E. I. Du Pont de Nemours & Co. Dec. 22, 1944. 34721/45.

Azo-dyestuffs capable of being chromed.—J. R. Geigy A.G. Dec. 21, 1944. 33488/45.

Condensation products.—J. R. Geigy A.G. Dec. 19, 1944. 34223/45.

Complete Specifications Accepted

Electrode arrangement infusion electrolytic cells.—S. Kloumann. April 18, 1944. 578,026.

Drawing dies.—S. Kryszek, Hard Alloys, Ltd., and Caledonian Metal Co., Ltd. June 20, 1944. 578,066.

Purification of calcium sulphate.—P. Kubelka. Dec. 29, 1938. (Convention date not granted.) 577,970.

Catalytic treatment with hydrogen of glyceride oils or fats.—Lever Bros. & Unilever, Ltd. Feb. 19, 1943. 578,102.

Fibres, films and the like.—D. McCreath, and I.C.I., Ltd. March 5, 1943. 578,016.

Production and esterification of esterifiable nitroparaffin derivatives.—A. McClean, and I.C.I., Ltd. April 16, 1943. 577,984.

Process for the preparation of alkoxyisobutyric acids.—P. May. (C. Weizmann.) April 15, 1943. 578,082.

Melting of metals.—A. G. E. Robiette, and P. F. Hancock. Feb. 10, 1944. (Cognate applications 2507/44 and 2249/45.) 578,023.

Production of allyl alcohol and esters thereof.—Shell Development Co. Sept. 1, 1942. 577,992.

Manufacture of new azo-dyestuffs.—Soc. of Chemical Industry in Basle. March 6, 1942. (Cognate applications 4906/43 and 4907/43.) 578,014.

Water-proofing of casein formaldehyde plastics.—J. B. Speakman, J. L. Stoves, and Erinoid, Ltd. Nov. 10, 1943. 578,148.

Production of tubes from thermoplastic materials.—R. L. Stephens, W. O. Steel, and I.C.I., Ltd. Feb. 4, 1944. 577,997.

Sulphur recovery.—M. J. Udy. Jan. 20, 1944. 578,136.

Manufacture of derivatives of phenanthridine.—L. P. Walls. July 7, 1943. 577,990.

Manufacture of highly polymeric substances.—J. R. Whinfield, and J. T. Dickson. July 29, 1941. 578,079.

Solvent extraction apparatus.—K. H. Wilks. June 23, 1944. 578,111.

Manufacture of hexakisazo dyestuffs.—Williams (Hounslow), Ltd., H. Ackroyd, and A. E. James. March 31, 1944. (Cognate applications 6010-11-12-13.) 578,000.

Preparation of an amino alcohol.—Wingfoot Corporation. Dec. 15, 1942. 577,983.

Recuperative heat-treatment furnace.—Aluminium Laboratories, Ltd. Sept. 22, 1943. 578,249.

Modification of the relative concentration of ions in fluid media.—American Cyanamid Co. Jan. 22, 1942. 578,307.

Polymerisation of trifluorochloroethylene.—American Viscose Corporation. July 14, 1943. 578,168.

Production of hydrogen-containing gases.—M. H. M. Arnold, and I.C.I., Ltd. April 7, 1944. 578,323.

Process of manufacture of polymers from acrylonitrile.—R. G. R. Bacon, L. B. Morgan, and I.C.I., Ltd. May 17, 1944. 578,209.

Adhesive bonding of surfaces or adhesive compositions (or processes of preparing the same) suitable for use therein.—B.B. Chemical Co., Ltd., L. E. Puddefoot, and K. J. George. Aug. 21, 1942. 578,304.

Aluminium copper alloy.—T. F. Bradbury, and T. J. Peake. Nov. 17, 1941. 578,222.

Method of producing cellular resin materials.—N. A. De Bruyne. Dec. 10, 1941. 578,264.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

BOUVERIE HOUSE, 154 FLEET STREET, LONDON, E.C.4

Telegrams: ALLANGAS FLEET LONDON — Telephone: CENTRAL 3212 (12 lines)

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1413. — July 27, 1946 — Annual Subscription 21s. Overseas 26s.

Reward for Invention

WE have it on high authority that this country must live in the future by the creation of new types of goods. We have seen other nations developing their industries to an extent so great as to threaten our overseas markets seriously in what may be termed standard lines of manufacture. It has lately been stated that Sweden faced a similar position in the last century. Before the British iron and steel industry was developed Sweden provided 39 per cent. of the world's steel requirements; now it supplies only 1 per cent. It is an interesting fact, however, that the actual tonnage of iron produced in Sweden is greater now than it was when that country supplied nearly two-fifths of the world's steel demands. Nevertheless, Britain must be facing much the same difficulty in many standard lines of manufacture, and the future of this country depends upon the extent to which, by invention or by research, we can produce new goods, set up new industries, and apply our skill to manufactures which cannot be undertaken by most of the rest of the world for one reason or another.

That being so, the key to this country's future prosperity appears to lie in the hands of its inventors and research men. These are they who by chance or by considered thought, by scientific research, by engineering development, or in other ways, contribute new ideas that can be applied to the manufacture of goods for which there will be a world market. The Minister of Supply at the luncheon to the Iron and Steel Institute expressed the national attitude to creative scientists of all kinds in language which is worth quoting: "We have emerged from the war with glory; we are battered, we are crippled, but we are still alive. We have come into a new and a rapidly changing world, a somewhat uncomfortable and unfamiliar world; but it is exciting, it is challenging, and it is adventurous. . . . Revolutionary developments are taking place in many fields. . . . This is a scientific age, and you who work in the scientific and technical field have the future of mankind in your hands." It is not enough to keep going as before. For us in this island it is not enough just to keep up with others; we have to struggle to maintain our technical superiority in those fields which are peculiarly our own.

An unfamiliar and But human nature adventurous world! still remains the same. There are and always will be those invent because they cannot help it. There will always be those occupy their time in scientific research

On Other Pages

because it is so interesting to them that they cannot conceive of any other interest in life. They are the few, they are the enthusiasts. In the view of the world they are slightly mad even as the anchorite or monk, who immures himself in his cell to pray for the world, is slightly mad. For the ordinary man and woman adventure is undertaken—and this particularly applies to industrial adventure—with a view to gain. We work hard, we may enjoy our work, but at the end of it we expect some material success in addition to the æsthetic satisfaction of a job well done. Rewards do not always follow on hard work even if it is successful. It has been made clear of late that Baird, the inventor of television, received no recognition from any Government, nor was offered any reward other than financial; and even that he had to strive for just like any other business man.

The modern spirit of socialism accords ill with a spirit of adventure, because while the socialists urge scientific and technical men and inventors to give of their very best, they withold rewards, on principle. It has become indecent to make profits. If profits are made they are removed by taxation as soon as possible. Even in Russia the successful scientific workers receive very large rewards, and the carrot of material success is ever held before the nose of the inventive donkey.

What should be the reaction of industry to successful development of processes in this country? It must be confessed that there have been too many examples in the past of a firm getting all the material profits and the employee getting none. We can cite more than one case which needs to be investigated. There is first the man who is engaged as a research worker and who is therefore, as it were, under contract to invent. If his work is successful should he be given any material reward other than normal increases in salary or position for which his mental gifts cause him to be fitted? Should he be given a percentage on sales—a royalty, in other words? There are two answers to this. The first is that the firm may employ many scientists and a very great deal of the work of those men must be unremunerative. The research worker is therefore entitled to nothing more than his salary. There is also the view that it is unethical to give rewards to the one man who happens to be successful simply because of the accident of having been put on to a particular line of research capable of yielding a materially successful result.

We confess that this is an exceedingly difficult matter upon which to pronounce any opinion. Our view at the moment is that a man who becomes a research chemist should not be entitled *as a matter of right* to rewards for successful processes which he develops. But if the success is clearly due to certain members of the research staff who stand out head and shoulders above their fellows, rewards in the shape of some sort of bonus should be given. It may be indeed that the outstanding work is of a purely negative character, but it should still rank for a reward whether it be successful in an industrial sense or not. The opinions of our readers upon this point would be welcomed because there is considerable debate on this matter just now in certain official circles.

The case of the inventor who is not paid to invent, *e.g.*, a production engineer who sees a better method of doing his job, comes under quite a different head, and we suggest that if a man is not engaged specifically to undertake development work he should always be given a percentage of any savings that he can make by a patentable invention. This again raises the point as to whether the application of the invention to the man's own firm should rank for such payment as a matter of right, or whether it is a question of the extent to which he can draw royalties from other applications of his invention outside his own firm.

It is for a specific purpose that we raise this question of rewards. There are many who do good work and there are many, therefore, who are in the running for rewards. It might be said indeed that the industrial artist who produces a really fine design is just as entitled to a reward as the research chemist who develops a new process. It is a matter on which there is a good deal of muddled thinking. One thing, however, appears to us to be clear, even though it may not be universally agreed. This country requires inventive genius and inventive effort in every field to the very greatest extent possible. The brave adventurous new world of the socialist is all very well for the theorist who is going to plan it, but it provides no incentive to the individual. The question that we should like to hear debated is this : How shall we get the necessary creative results if we do not offer adequate rewards; and how should those rewards be organised?

NOTES AND COMMENTS

"Britain Can Make It"

ALTHOUGH chemicals will not be directly represented, chemical manufacturers will doubtless find much to interest them in the "Britain Can Make It" national exhibition of industrial design in consumer goods which will be opened at the Victoria and Albert Museum, London, on September 24. How long the exhibition will remain open depends on the attendance of the public. Plastics and other materials are now being used to convert the museum into a large-scale "shop window for Britain" and an encouraging "progress report" was presented at a Press conference this week by Sir Cecil Weir, who has supervised the arrangements for liaison with industry. The exhibition, which will occupy 90,000 square feet, will cover the whole range of consumer goods, and it is estimated that more than 20,000 separate exhibits will be put forward by the fifty or so industries taking part. Space at the exhibition will not be sold, all the exhibits being selected by specially appointed committees, assisted by technical assessors nominated by the trades concerned. The exhibition has been planned as a gesture of confidence in the resilience and capacity of British industry, and its successful launching will mean that this country has completed the first step on the road to peace-time reconversion.

World Science Federation

IF the scientists have the last word, it will not be their fault that new discoveries are not used for the benefit of mankind in general. This is the impression derived from the international conference to found a world science federation, which was opened in London last Saturday by Professor P. M. S. Blackett in his capacity as president of the A.Sc.W. Some 14 countries were represented, the initiative having arisen from the British Association's conference on "Science and the Welfare of Mankind." The purposes of the International Federation of Scientific Workers are, broadly, to ensure the fullest use of science in promoting peace and human welfare, and to secure international co-operation in science and technology. Immediate items in the programme are the peaceful use of atomic energy and the rehabilitation of devastated countries, as well as the application of science to under-developed countries. Furthermore, improvement in scientific teaching is to be studied as well as the betterment of conditions among scientific workers. Co-operation with U.N.E.S.C.O. and similar bodies is to be encouraged. This is a pretty comprehensive programme, but it seems fairly obvious to us that something of the kind must be put in hand, and put in hand quickly. It has been said often enough that Science knows no frontiers. That was true enough up to, say, 80 years ago; but recent events have made it appear a somewhat hollow sentiment. The present step, we fully believe, may be regarded as a real advance towards the revival of that ancient truth. The names of the elected officers of the new Federation tend to strengthen this good hope: they are, F. Joliot-Curie, president; N. N. Semenov and J. D. Bernal, vice-presidents; Harlow Shapley treasurer—a remarkable international team.

Alteration in Law

EMPLOYERS and employees alike in the chemical industry are affected by a recent alteration of law regarding claims for damages arising out of personal injuries sustained in the course of employment. Hitherto, damages could not be given if it could be proved that there was contributory negligence on the part of the injured person. Under the recent Law Reform (Contributory Negligence) Act, however, this no longer applies. The new Act lays it down that if a person claims damages under Common Law in such cases, the claim shall not fail by reason of contributory negligence on the part of the claimant, but the amount of the damages allowed shall be reduced to such an extent as the judge (or jury if there is one) considers just and equitable, having regard to the claimant's share in the responsibility for the accident. Although an injury may come under the Workmen's Compensation Acts, the injured person may make a claim under Common Law if he so chooses, but if he fails by this method the Court may, nevertheless, assess damages under the Workmen's Compensation Acts. The new apportionment rule applies also to cases under the Law Reform (Miscellaneous Provisions) Act, 1934, and the Fatal Accidents Acts, 1846-1908. An important proviso is that in all cases where a contract limits liability, the amount of damages re-

coverable under the new legislation cannot exceed the maximum amount laid down in the contract.

Platinum Boom

IT seems unhappily inevitable that the chemical industry must suffer from the "boom" in platinum, which has caused that precious metal to rise in price from £14 per oz. to about £17 in the last month or two, after having remained stable at £9, thanks to price control, for several years. The principal reason for the rise is said to be the demand from the jewellery trade, which was "starved" of platinum during the war, and, in America especially, is now taking full advantage of the removal of the ban on trading and is buying heavily. At the same time it is stated that the output of platinum metal, about 750,000 oz. in 1939, is considerably reduced—though no current figure seems obtainable. During the war platinum, already important as an industrial raw material in the chemical and electrical industries, found many new uses, and, according to a financial correspondent of the *Manchester Guardian*, the present boom may not only prevent further development, but may even undermine much of the progress achieved before and during the war. While the present feverish buying rush continues—it is stated that speculators are paying as much as £24 an ounce—it will obviously be an uneconomic proposition to attempt to expand industrial uses. This boom will be a bad thing for the trade in the long run, as well as for the advancement of chemical science.

State Control of Flavours

ACCORDING to a British United Press message, Russia now has what is officially described as a "Ministry of Gustatory Industries," that is to say, a Ministry of Tastes, dealing with spirits, wines, perfumes, mineral waters, and beer. It has, they say, been formed from a department of the Ministry of Food. This is a real advance in the control of public opinion, which we should hate to see reproduced in this country, though doubtless a qualified theorist could defend it as good sound socialism. It is bad enough to have the quantity of our wine, beer, etc., controlled, without having its flavour dictated as well. It is perhaps not generally known that our Soft Drinks Control during the late war was in charge of a Professor of Ecclesiastical History from one of our older-established universities, but we do not feel that this should be regarded as a precedent; it appears to us to be an injustice to the chemical industry. If agreeably scented esters are, in the words of Miall, "used as flavouring essences and perfumes," they are also, under the same authority, used in many chemical processes. There are not a few members of the Society of Chemical Industry who would be excellently suited at any rate for the job of Under-Secretary for Aromatic Esters when the chemical industry is nationalised—with the reversion of the Ministry of Gustatory Industries, if and when formed; and we leave it to our well-informed readers to think out some suitable names. Wild horses will not drag any suggestions from us.

Institute of Fuel

Royal Charter Granted

MEMBERS of the Institute of Fuel were notified this week, in a letter signed by the president, Dr. E. W. Smith, and the chairman of the Charter Committee, Mr. C. H. Lander, that the King has been pleased to approve the grant of a Charter to the Institute.

The letter added: "Although we are not yet aware of the date at which the Royal Charter will become operative, we feel sure that you would wish us, in taking this early opportunity of acquainting you of this noteworthy development, to place on record our thanks on your behalf to all those, particularly Sir John Greenly, Mr. H. A. Humphrey, and the other members of the original Charter Committee, as well as our fellow-members of the present committee, including Dr. G. E. Foxwell, as Charter Secretary, who, by their continued interest and devoted efforts, have been instrumental in securing the grant."

CHEMISTRY SCHOLARSHIPS

Among 19 scholarships awarded by the Miners' Welfare National Scholarship Scheme and Students' Exhibitions Fund for 1946 are two for an honours degree course in chemistry. These go to G. O. Phillips, of Rhos, Denbighshire (tenable at Manchester University), and A. H. Wragg, of Kiveton Park, Yorkshire (tenable at Sheffield University). Eight exhibitions include one for an honours degree course in chemistry, awarded to J. B. Brown, of Atherton, Lancashire (tenable at Manchester University).

Beryllium Metal

Methods of Manufacture Described

IN view of the monopoly of beryllium metal production formerly held by Germany, detailed information on the methods of manufacture employed is extremely valuable. A recent report (B.I.O.S. Final Report No. 319, Item No. 21) supplements to a considerable extent the scanty data given in an earlier report regarding the manufacture of beryllium metal at the Degussa works, Frankfurt-am-Main (THE CHEMICAL AGE, 1946, 54, 403). According to this latest report the methods of production and the plant employed by the Degussa firm were not of that high efficiency and meticulous order which are frequently claimed as characteristic of German industry. To quote from the report "It was pretty clear that the plant for this process had been scraped together from old material lying about; and even when rather special apparatus had to be installed, this gave the impression of having been compounded of second-hand items. The whole establishment and procedure gave the impression of 'backyard manufacture.'"

As shown on p. 99, the process consists of two main sections. First, the production of pure anhydrous beryllium chloride from the mineral beryl, and second, the electrolytic reduction of the chloride to metal. Raw material employed is ore containing the mineral beryl ($3BeO.Al_2O_3.6SiO_2$) with an average content of 10 to 12 per cent. BeO (or 3.5 to 4.0 per cent. metallic beryllium). With a recovery of 78 to 80 per cent. and an ore cost of 150 RM. per ton the metal selling price was about 2.1 RM. per lb.

How Recovery is Effected

The first step in the recovery operations is the decomposition of the beryl mineral by fusion with the necessary quantities of lime to give mono-calcium aluminate ($CaO.Al_2O_3$) and calcium disilicate ($CaO.2SiO_2$). Fusion of the ground mixture of ore and lime is effected by heating to 1500° C. for 1½ hr. in a rotary kiln fired with town gas, the kiln being 3 ft. 6 in. in diameter and 6 ft. long with a 9-in. thickness of monolithic fireclay lining. The molten product from the kiln is quenched in water to promote disintegration, the material being subsequently dried and ground to a fineness equivalent to a 72 B.S.I. screen.

Treatment with sulphuric acid results in the formation of insoluble silica and calcium sulphate, leaving beryllium and aluminium salts in solution. The ground clinker is treated with 78 per cent. sulphuric acid in an iron trough, the mixture being continuously stirred until it sets into a dry powdery mass. This mass is then transferred to a steam-jacketed lead-lined vessel to which a wash solution from a subsequent operation is added. Additions of small quantities of glue are also made to aid the precipitation and filtration of the silica and calcium sulphate.

The slurry is then transferred to a wooden plate-and-frame filter-press by a porcelain-lined acid pump, nitrocellulose cloths being employed for filtration. From the filter-presses the clear liquor (about 30° Bé.), with aluminium, iron, and beryllium salts in solution, is transferred to lead-lined agitating tanks equipped with cooling coils. Hot ammonium sulphate solution is added in excess and the liquor cooled to facilitate crystallisation of ammonium aluminium alum. Separation of the alum crystals is effected in ordinary batch centrifuges, the alum being discarded to waste as it is too impure for sale. Complete elimination of the aluminium salts is not secured, approximately 0.5 per cent. as Al_2O_3 remaining in the solution.

Precipitation of Beryllium Hydroxide

Removal of the iron salts is effected by oxidising the iron to the ferric state by the addition of hydrogen peroxide and adjusting the *p*H of the solution to 4.0 by additions of calcium carbonate. Precipitated iron hydroxide and calcium sulphate are removed in wooden plate-and-frame filter-presses equipped with cotton cloths. The solution from the filter-presses, containing about 0.5 per cent. of iron as Fe_2O_3, is pumped into agitators lined with acid-resisting brick. Ammonia gas is passed into the agitator until all free acid is neutralised and the beryllium precipitated as the hydroxide. Apparently, although a large excess of ammonium sulphate was formed at this stage, no attempt was made to recycle the solution after concentration for the formation of ammonium aluminium alum.

Beryllium hydroxide is separated from the solution by filtration in wooden plate-and-frame filter-presses. Should a very low iron content be imperative, the precipitated beryllium hydroxide is dissolved in ammonium carbonate solution, filtered, and subsequently treated with sodium sulphide which precipitates any iron as the sulphide, any such precipitate being subsequently filtered off. Beryllium carbonate may be precipitated from this purified solution by dilution and boiling with steam.

Beryllium hydroxide is spread on iron drying trays lined with filter-cloths, the trays being subsequently transferred in batches to a steam-jacketed drying cabinet where the water content is reduced to about 50 per

cent. A plastic mixture of dried beryllium hydroxide and powdered wood charcoal is prepared for extrusion by the addition of suitable quantities of wood tar and water. This plastic mass is then extruded into a rod of $\frac{7}{8}$ in. diameter by a hydraulic press,

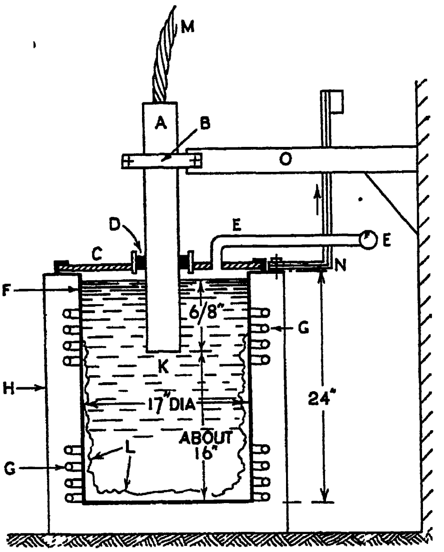


Fig. 1.

the rod being subsequently dried and broken into short lengths. The short lengths of dried rod are packed in charcoal in clay crucibles, the contents being covered with a layer of charcoal and an air-tight lid finally fitted. These small crucibles—10 in. in diameter and 15 in. high—are then passed through a 100-ft. tunnel kiln in which a temperature of 800° C. is maintained by burning town gas. During the 24 hours occupied in traversing the length of the kiln the beryllium hydroxide is dehydrated completely to beryllium oxide, while volatile material is expelled, leaving a hard porous mixture of beryllium oxide and carbon.

Chlorination of this oxide in the presence of carbon is carried out in an electric furnace, the carbonised rods constituting the resistor element of the furnace. The chlorination furnace is a brick-lined box with two 12 in. by 5 in. electrodes arranged vertically, leaving a 24 in. space which is filled with the carbonised rods, the top of the furnace being closed with a gas-tight lid. Alternating current at 120 V. from a 12 kW. supply is fed to the electrodes, the temperature gradually rising to 700-800° C., when chlorine gas is admitted through the base of the furnace. In the presence of the carbon and chlorine the beryllium oxide is transformed into the chloride which volatilises at the temperatures obtaining. Escaping through a duct near the top of the furnace, the volatile beryllium chloride passes into a condenser where it solidifies.

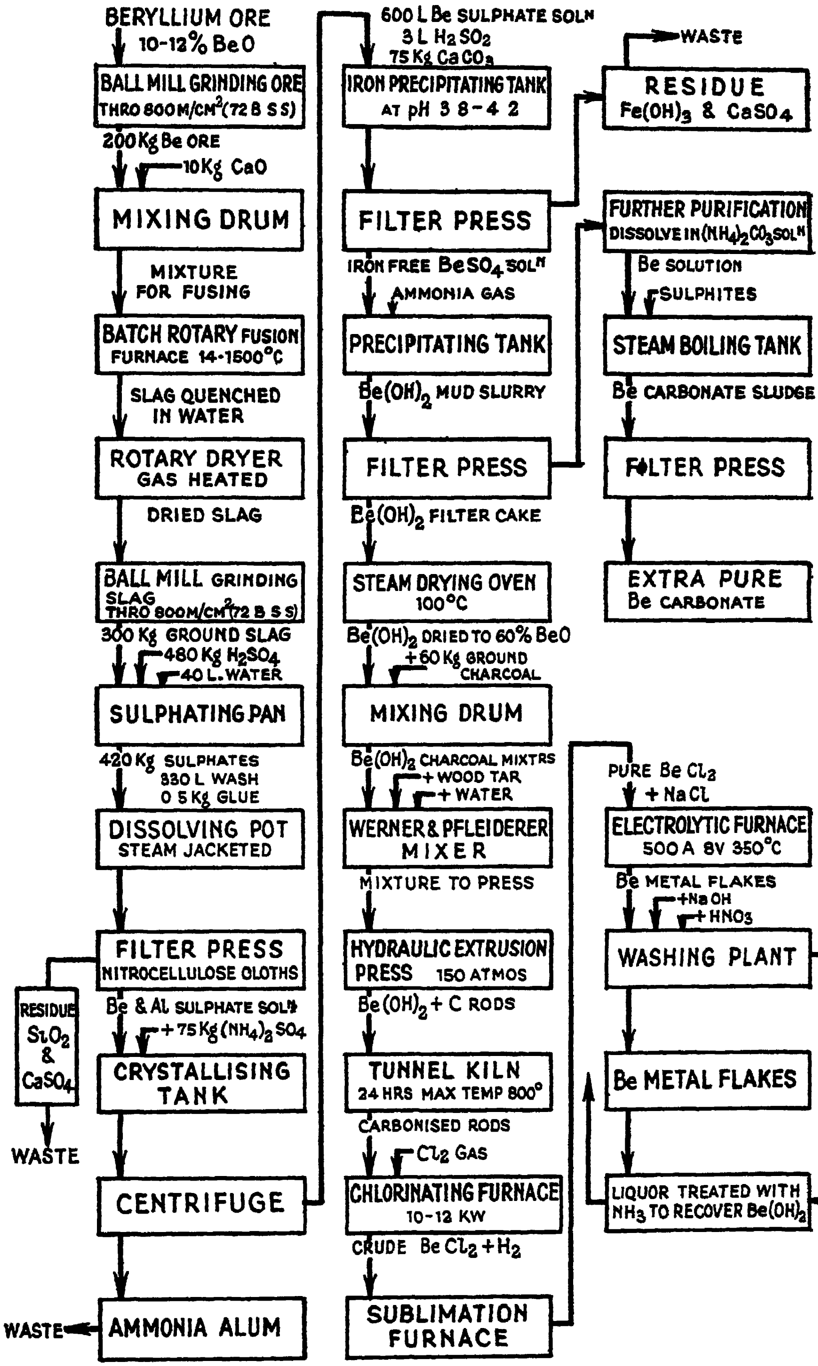
To secure greater purity, the crude chloride from the chlorination furnace is redistilled at a temperature of 550° C. in a hydrogen atmosphere, the furnace being fired with town gas. The volatile chlorides are passed through two condensers in series, the first being maintained at a temperature of 350° C. and the second at about 150° C. High-purity beryllium chloride is deposited in the first condenser, while beryllium chloride contaminated with the chlorides of aluminium, iron, and other metals collects in the second condenser. The contents of the second condenser are returned to an earlier stage in the process for the extraction of the beryllium. Should it be necessary to store the beryllium chloride produced, air-tight aluminium containers must be employed to prevent deliquescence.

Electrolysis

In the final stage electrolysis of the beryllium chloride is carried out in nickel crucibles with auxiliary external electric heating, the nickel crucible constituting the cathode of the direct current electric supply. As shown in Fig 1, the nickel crucible, 2 ft. in diameter by 17 in. long and 2 in. thick, is practically flat-bottomed and flanged at the top. Two groups of electric heating coils surround the crucible, alternating current being supplied at 220 V. with a maximum of 20 amps. in each. The power fed to each coil may be controlled so that the heating range is from 8.8 kVA. to zero.

The anode is a graphite rod 4 in. in diameter immersed in the charge to a depth of 6 to 8 in., the rod being held in a steel clamp and connected to the current supply by a copper rope. The cathode connection is taken by aluminium tape bolted to the flange of the crucible at the back of the furnace, the tape being connected to an overhead busbar coupled to the anode connection of the next live furnace. The furnaces are coupled electrically in sets of five, power being supplied from an M.G. set delivering 500 amps. When starting electrolysis the series voltage in the circuit is 45—that is, 9 V. drop across each furnace. As electrolysis proceeds the voltage falls to 25—that is, 5 V. across each furnace. At maximum load the current density on the anode section is 40 amps./sq. ft.

In the usual method of operating, the crucible is hot and the charge consisting of beryllium chloride with an equal weight of sodium chloride is brought up to the desired operating temperature of 350° C. in about an hour. The total weight of the charge at the start is about 160 kg. Electrolysis is continued for 24 hours, after which the current is cut off and the liquid portion of the charge ladled into a neighbouring furnace.



Manufacture of Beryllium by the Degussa process.

As both beryllium and chlorine are given off from the liquid charge during electrolysis, a fresh addition of the purified chloride must be made to adjust the composition of the charge in this second furnace to the original ratio of 50 per cent. $BeCl_2$ and 50 per cent. NaCl. Electrolysis is then restarted with this new charge.

The beryllium metal released during electrolysis occurs as flakes adhering to the sides and bottom of the first crucible, from which the liquid charge has been ladled. The flakes are scraped out and treated in a hand-operated colander press to remove the associated liquid chlorides. Output of beryllium metal from each furnace per day is given as 1.1 to 1.2 kg. As the total power supply to the furnace is about 12,000 kWh. per day, the metal yield represents a current efficiency of about 50 per cent., but the calculation takes no account of power used in the heating circuit. The consumption of chloride corresponding to the metal production is about 10 kg. Chlorine evolved during the electrolysis escapes through an uptake pipe and is discharged to waste.

The short run of electrolysis—24-hour periods—is caused by the rapid rise in the melting-point of the bath due to the reduction in the beryllium chloride content. After 24 hours' run the beryllium chloride content has fallen to about 45 per cent. and the melt begins to thicken. Impurities gradually accumulate in the bath, which has to be discarded after a period of 2 to 6 months, the exact time of discard being determined when the daily yield of metal falls below a certain minimum value. The rejected material is returned to an earlier stage in the process for the extraction of the beryllium.

After washing with cold water and nitric acid the beryllium metal flakes are redistilled, the final metal content being 98 to 99 per cent. The only available record showed the following analyses of the beryllium metal:

Impurity	Percentage
Insoluble in hydrochloric acid (mostly graphite)	0.1 to 0.3
Ferric oxide	0.1 to 0.4 (as Fe)
Aluminium oxide	0.2 to 0.8 (as Al)

Maximum production at the Frankfurt factory of the Degussa firm was 160 to 180 kg. of beryllium metal per month. According to the information the selling price of the metal was 350 RM. per kg. With ore at 150 RM. per ton, it was claimed that extraction could be carried out profitably, but it was maintained that increases in the ore prices in later years had rendered this price uneconomic. Based upon experience gained at the Frankfurt works, a new factory had been planned and partly equipped at Rheinfelden. Plant had been installed at this new factory up to the stage of purified beryllium chloride production. For a short time before May, 1945, all the stages of the extraction process up to the production of the beryllium chloride had been carried out at Rheinfelden, the chloride being then transferred to the Degussa works at Frankfurt for electrolysis.

Saccharin from Anthranilic Acid

Report on German Process

ANTHRANILIC acid (*o*-amino-benzoic acid) has been found to be a satisfactory starting material for the synthesis of saccharin (*o*-sulphobenzimide), according to a translated report from the German, PB 901, of the Office of the Publication Board, U.S. Department of Commerce.

The principal steps in the synthesis have been described in Ger. Pat. 130,119 and 122,567, issued to Ciba. The process involves the diazotisation of anthranilic acid to produce *o*-carboxymethyl benzene sulphinic acid, followed by the introduction of chlorine gas into an alkaline solution of the sulphinic acid to form the *o*-carboxymethyl benzene sulphochloride. This product is converted to saccharin by the addition of ammonia.

I.G. Farben researchers found that a high yield of the sulphinic acid was obtained when the diazotisation was carried out in aqueous sulphuric acid solution, with sulphur dioxide added in liquid form to the cooled diazotate. Pure copper powder was used to start the reaction instead of copper salts. Removal of the copper sludge by filtration from the slightly alkaline solution allows production of the sulphinic acid in an easily filterable form upon acidification with mineral acid. It was also observed that addition of chlorine gas to a slightly alkaline solution of the sulphinic acid converted it into the sulphochloride which precipitated quantitatively for removal by filtration. Addition of the *o*-carboxymethyl benzene sulphochloride to ammonia converted it to saccharin, which was isolated by acidification with hydrochloric acid. The yield was about 90 per cent. based on the sulphochloride.

Based on anthranilic acid, the yield was 58-60 per cent. In Germany it was stated that the cost price was as low as that of the Fahlberg process.

A distinguished United States chemist, Dr. R. Williams, the principal inventor of the "Principia" process used in the manufacture of vitamins, has recently arrived in Shanghai at the invitation of the Chinese National Health Administration. His main task will be the working out of a method of enriching rice to eradicate ber-beri.

Phosphating Metallic Surfaces

IV. Anti-Trust and Patent Litigation in the U.S.

by W. G. CASS

(*Continued from* THE CHEMICAL AGE, *July* 20, 1946, *p.* 70)

PHOSPHATING in the U.S.A. is chiefly associated with the Parker Rust-proof Co., of Michigan, and other firms under its control, including: the Rust-proofing & Metal Finishing Corporation, of Cambridge, Mass.; the Pyrene Manufacturing Co., of Newark, N.J.; the Parker Wolverine Co., of Detroit; the Western Rust-proof Co., of Chicago; and the Parker Rust-proof Co., of Cleveland. Before the war Parker also had numerous associated companies in Europe—some of which have been re-established—as well as the Pyrene Co., Ltd., in England (Metal Finishing Division)

Anti-Trust Suit

The report of the judgment given in the suit brought against the company by the U.S. Government under the anti-trust laws gives an interesting account of the rise and progress of its phosphating business; and a brief exposition of the application of these laws in the present case. They are mainly contained in the Sherman and Clayton Acts The report, which is given in full in the *U S. Patents Quarterly* (1945, 65, 563), usually quoted as 65 USPQ, admits the thoroughly sound and fair business methods adopted by Parker, including its agreement with its former great rival, the American Chemical Paint Co., which was entered upon in good faith and without conscious attempt to establish an undesirable monopoly. However, after a thorough investigation the Court found the agreement illegal under the anti-trust laws, and it was ordered to be annulled.

It was alleged that Parker secured a monopoly of the so-called rust-proofing business by use of its patents, by joint action with its licensees, and by various agreements for buying up its most important competitors. The company made no secret of its policy in this direction and was fully convinced, on its interpretation of the anti-trust law and from previous cases in the courts, that there had been, either in intent or in actual fact, no violation of that law.

The company's rise from small beginnings to its present predominant position is here briefly outlined. Starting with a small shop for surface treatment of parts and accessories in the automobile industry, the company was organised in 1915 for promoting the use of chemical coatings applied to metal surfaces generally, especially iron and steel, to prevent or retard corrosion and to provide a suitable basis for paint or other finishes. The principal method used was that of phosphating. The first patents acquired by Parker were those of Richards (U.S.P. 1,069,903), and Coslett (U.S.P. 870,937; equivalent B.P. 8667/1906). This latter process proved very successful, and in 1925 Parker brought a suit against the Ford Motor Co. for infringement. After a lengthy and expensive trial the plaintiffs were awarded substantial damages.

Parker has always maintained a staff of chemists and engineers to improve its products and to provide skilled servicing. This was the more necessary since it has always been in competition with other forms of corrosion resistance, such as galvanising, sherardising, and plating, and with scientific organisations engaged in the search for better means to resist corrosion by metal surfacing, paint-bonding and so forth. A partial monopoly was certainly conferred by the American patent laws, but this was anything but complete or water-tight, especially having regard to the many other alternative methods of protection; moreover, some of the earlier patents have now expired and are free to all. There was need for constant vigilance and research to improve existing patents and provide material for new ones. This, combined with good salesmanship and servicing under a well-controlled licensing system, has accounted for much of the firm's success. It was thus that, before the expiry of the Richards and Coslett patents, Parker had improved processes, such as that of Tanner and Lodeesen, assigned to the company by these two employees under U.S.P. 1,911,726, in 1933. Among other things the time required for phosphating was, in this improved process, considerably reduced. Numerous other improvements have been patented since then in the U.S.A. and elsewhere.

No Restrictive Agreements

At the date of the trial most of Parker's business was carried on with very large corporations, and manufacturer customers accounted for 97 per cent. of the business. With the exception of the agreement with the Norge Division of the Borg Warner Corp, all these customers were treated alike, and there was no understanding or agreement to restrict purchase of other materials and methods from competitive sources.

The company also entered into agreements with non-manufacturers for jobbing purposes or treating with Parker processes the work of outside concerns, in some cases

with exclusive territorial rights, but as already indicated this accounted for only a very small part of the total business. There were also in these cases no restrictive agreements to limit competition. As business increased, prices were reduced, and there is no evidence that the firm ever earned excessive profits. The standard method of computing prices was quantity of material used. It made no difference to a licensee under a Parker patent whether it paid a fee on the basis of amount of work processed, or whether it bought the patented compositions from Parker at a price that included a royalty.

Relations with A.C.P.

In 1932 the American Chemical Paint Co., which had hitherto been engaged primarily in supplying materials for cleaning metal surfaces prior to painting or other finish, began to furnish also materials for phosphating, and at once came into conflict with Parker. There were frequent threats of suit for infringement, and, despite attempts to reach agreement by merger or otherwise, there was active competition between the two companies up to October, 1940.

Three years before that (in 1937) Parker had brought a suit against the Norge Division of the Borg Warner Corp.—one of the America Chemical Paint Co.'s customers or licensees—but A.C.P. was not a party to this suit. It was held that the A.C.P. process as carried out by Norge did not infringe the Parker patent No. 1,911,726 (38 USPQ 468: *see* Appendix " B "). An appeal was, however, taken to the Circuit Court of Appeals (*see* below). In May, 1937, A C.P. brought a suit against Parker alleging this same patent invalid and not infringed by A.C.P.'s processes and materials. Parker filed a counter-claim alleging infringement, and was upheld by the Court. A.C.P. appealed and eventualy there was an agreement between the two companies under which A.C.P. could continue to supply and service some of its customers pending determination of the appeal.

In December, 1939, J. H. Gravell died. He was the original inventor, and president of the American Chemical Paint Co. and owner of nearly all its stock, and control of the company passed into the hands of several employees. In October, 1940, a further agreement was entered into with Parker while the two appeals were still pending. Under this agreement Parker was given exclusive license on all A.C.P.'s rust-proofing patents and applications for a period of ten years, for the sum of $750,000, payable in annual instalments, provided that the license might be extended for the life of the patents by payment of an additional $50,000 at the end of the ten years. Any further improvements or new inventions would be assigned to Parker, who, for their part, agreed to purchase from A.C.P. all materials on hand. The two suits pending on appeal terminated with a reversal of the judgment in respect to Norge and a confirmation of the judgment against A.C.P. Other pending infringement suits were dismissed, so that A.C.P. was permanently enjoined from carrying on the principal process it had been promoting. Its trade marks were included in the agreement.

This 1940 agreement was intended to eliminate A.C.P. as a competitor, even if Parker did not actually intend to restrain trade and stifle competition. As neither A.C.P. nor any of its employees would benefit in any way by new inventions or improvements, none was made nor likely to be made, since there was an obligation to turn them over to Parker without further recompense. Parker sought to justify this agreement on the ground that it was merely the purchase of patent rights, the settlement of litigation, and the purchase of a business. The use of the term " merely " appears a little inept in this connection, and the attempt to minimise the size or importance of a transaction is no argument in its favour. The view of the Court was that it could not be justified on these grounds and went beyond the achievement of the ends stated. Patent rights may be purchased like any other property, but the fact that patents are involved cannot, under American law, justify a contract which has the object or effect of restraining trade and eliminating competition. There is little doubt, the court judgment says, that one effect undoubtedly was substantially to reduce competition.

The Curtin-Howe Agreements

Another former competitor of Parkers was the Curtin-Howe Corp., organised in New York in 1927. At first the company was engaged solely in promoting the use of wood-preserving inventions developed by Dr. L. P. Curtin, a research chemist. In 1932 he assigned to the company a patent he had secured for a rust-proofing process, which they proceeded to develop, and at once came into conflict with Parker. Other patents and inventions followed. These were also opposed by Parker, who started interference proceedings in the U.S. Patent Office. The Curtin-Howe Corp. was not strong financially from the start, and in 1929 it had sold 51 per cent. of its stock to United Chemicals Inc., in order to secure additional capital. This latter company was not anxious to carry on the business, and endeavoured to sell its patents or grant exclusive licenses. None of these attempts was successful. The company continued to work at a loss—up to $100,000 by 1940.

Ultimately, in November, 1940, Parker bought all the C.H. patent rights in the rust-

proofing and priming fields for $225,000, and retained Dr. Curtin as consultant on a three-year contract. The Court held that the agreements with the Curtin-Howe Corp. were quite legitimate, and did not substantially reduce competition which, in fact, had hardly existed beforehand. There was thus little or no restraint of trade, within the meaning of the anti-trust laws. But it was held that the agreement with A.C.P. was quite different, and although the U.S. Government had failed to prove that it was entitled to any other relief, it was entitled to a judgment that the agreement between Parker and A.C.P. and the officers thereof was illegal. Parker was therefore enjoined from enforcing any of the rights secured under the agreement, including the patents included therein. Judgment was entered accordingly on May 28, 1945.

Despite the gentle and almost velvet-glove-like manner in which the judgment was delivered, it was a rather heavy blow to the Parker Rust-proof Co.; and this despite the fact that the Court felt constrained to include in its judgment a sort of apologia or defence of the American anti-trust laws, thus: These laws were not enacted for the purpose of forcing every type of business into a common mould, or for creating evils or burdens—such as undue interference with business enterprise—greater than those they sought to remedy. Each case must be considered on its merits, and only such contracts and obligations as would prejudice the public interest by unduly restricting the course of inter-State trade come within their scope. The general objectives of the patent laws and of the anti-trust laws are much the same. The former protect the inventor while working and developing his processes, and the anti-trust laws prevent the erection of artificial barriers to intelligent and energetic competition, the complete freedom of which is usually in the public interest.

Further, under American common law, the owner of a secret process is also protected. It would be contrary to the national sense of justice to induce an inventor to make a public disclosure and then deprive him of the benefits by unduly restricting his rights to make use of it. Therefore the anti-trust laws do not include contracts entered into in a legitimate exercise of patent rights which include the fixing of royalties and selling prices, the proportion of total output which a licensee may manufacture, use, or sell, area of territory, and so on; always provided that no condition is attached which would have the effect of enlarging the patentee's monopoly beyond that covered by the patent.

Results of the Judgment

The practical result of the above decision on the rust-proofing patent position is not too clear; but it would seem that the American Chemical Paint Co. has resumed independent activity in the patent field, and there have been several recent British applications (on a corresponding American basis). Two of these, for example, which reached the "open to public inspection" stage some time ago are: 13759/44, Treatment of metal surfaces and agents employed therefor; or more specifically, preparation of iron or aluminium or their alloy surfaces for paint by treatment in final rinsing solution which contains either phosphoric or chromic acid or both, together with a wetting agent. (It will be noted that this appears to be one of the many attempts to apply phosphating to aluminium and its alloys); and 22401/45, Protection of cupriferous surfaces.

Alleged Patent Infraction

In the case of Parker Rust-proof Co. v. the Borg Warner Co. (Norge Division), there was an alleged infringement of U.S.P. 1,911,726, Claims 2, 3, 4, assigned to the Parker Co. by Tanner & Lodeesen, 1933.

This is Parker's Spra-Bonderite patent for rustproofing by phosphating iron or steel articles, using baths of ferrous-, manganese-, or zinc-phosphate, or combination of these phosphates. The claims in question are process claims and relate more particularly to means for oxidising the hydrogen formed, *e.g.*, by addition to the bath of an alkaline nitrate, to expedite the process. It was alleged that defendants, by addition of sodium nitrite to a phosphating bath used for coating steel cabinets and refrigerators, were infringing. The defence was non infringement and non-validity. The Court did not pass judgment upon the matter as it was held that the case for infringement had not been sustained.

The essence of plaintiff's invention is the removal of hydrogen so that a gas blanket does not form on the surface of the metal and slow up the reaction. Almost any suitable oxidising agent can be used, and a large number has been named in the patent literature, but especially nitrates, nitrites, and sulphites.

Defendant's process on the other hand (the Borg Warner) consists in the use of a zinc phosphate coating solution prepared by diluting with water the chemical Granodine 30, made by dissolving 1¼ lb. of zinc oxide in ½ gal. of 75 per cent. phosphoric acid plus ½ gal. water, in order to make the coating bath a 2 per cent. solution of Granodine 30. This dilute solution is placed in a 1600-gal. tank. High-pressure spraying apparatus is provided, bearing on both sides of the parts to be coated, together with suitable collecting channels, return pipes, etc. Time required is said to be one minute, acceleration being largely due to spraying under high pressure and addition of nitrite. Granodine 30 is continually fed

to the bath to maintain the zinc phosphate content and free phosphoric acid content at the desired values, as these constituents are of course constantly being used up. A solution of sodium nitrite known as "Toner" is also continuously fed at the rate of 2-2½ gal. per hour.

Mechanical Action of Spray

It was urged by defendant that the sole function of the nitrite is to maintain the solution at its original strength so that the process can be continuous and accelerated; and that the purpose of the "Toner" is to prevent injurious accumulation of ferrous phosphate which would interfere with the coating process. Spraying is done under pressure at the rate of about 1760 ft. per min., so that a large volume of solution at full strength is projected within a minute against the entire surface of the article treated. As fast as the solution contacts the surface, it is blasted away by the incoming fresh solution. The speed of the process is therefore largely or mainly due to the mechanical action of the spray, and the oxidation of hydrogen plays little or no part in accelerating.

It is undisputed that sodium nitrite is an oxidiser of ferrous phosphate into ferric (insoluble), which is precipitated as sludge. It is also undisputed that evolution of hydrogen is a necessary incident of the coating process. It was found experimentally that the addition of sodium nitrate to the baths failed to preserve defendant's solution at full strength; but by introducing sodium nitrite the desired results were obtained. It must be concluded therefore that the conversion of ferrous into ferric phosphate and not oxidation of hydrogen is the principal reason for defendant's successful working.

The difficulty with plaintiff's position, continued the Court, is that they claim the specific method of expediting operations by oxidising the hydrogen as formed. The record is convincing, however, that hydrogen oxidation plays no substantial part in the speed of working of defendant's forcible spray process.

The spray process was well known in the prior art, but when Parker first placed on the market phosphating solutions containing nitrate in 1931 it was for the dip or immersion method. It was then known as Bonderite B, and as thus used the time required for five minutes. Previously the quickest time had been ten minutes, using the ordinary Bonderite A preparation, which contained no nitrate. Somewhat later a Bonderite X preparation was introduced, requiring a time of two minutes. It was not until 1935 that plaintiffs first introduced their improved direct spray method known as Spra-Bonderite, by which the process time is said to be reduced to one minute. The degree to which acceleration was due to change from immersion to spray does not appear, but it is highly probable that it was very substantial.

While it may be true that the nitrite used by defendant does in some degree oxidise the hydrogen, there is no evidence that it serves to remove a hydrogen blanket or reduce a visible bubbling action. The evolution of hydrogen in the solution with and without nitrite was easily observable in the court exhibits. Such an observation is impossible in the spraying process, and it may well be doubted whether a hydrogen blanket is possible at all in the forcible spray process. In any case, plaintiff has not established that the acceleration obtained by defendant in his spray process is due to oxidation of hydrogen by addition of sodium nitrite.

The need for maintenance of a proper balance in coating solutions has long been recognised. When a zinc phosphate solution is used it will be thrown out of balance by formation of ferrous phosphate which must be continuously removed if the bath is to operate efficiently. This was an old and well-known practice. The court concluded that there was nothing in plaintiffs' patent in suit to prevent defendants from applying this old-established principle in their spray process. No infringement being found, the bill of complaint was dismissed. (U.S.P.Q., 38, 468). This judgment was reversed on appeal.

Quinine in the East Indies

Java Plantations Undamaged

ACCORDING to reliable information which has recently reached Holland, the cinchona plantations of Java and Sumatra have, exceptionally, escaped any serious war damage and it is expected that the pre-war rate of production of natural quinine from this source will be reached as soon as the present political issue is settled. During the war the Japanese set up two new quinine factories (at Soekaboemi and Garoet), thus greatly increasing the manufacturing capacity of the Indes, which was formerly centred in the Dutch-owned plant at Bandoeng. The estates supplied some 100,000 kg. of quinine sulphate content to the manufacturers during 1942-45, approximating to two years' "standard production" of the pre-war cartel. The new plants and installations were found nearly intact when the Japanese left the country, but exact information is still lacking on what has happened since under Indonesian rule. The Bandoeng factory, which is in the British-occupied zone, still possesses bark supplies amounting to nearly one-third of the whole pre-war world consumption of some 700,000 kg.

Industrial Electronics

Visit to B.T.-H. Rugby Works

TO aid in demonstrating the manifold applications of electronic apparatus in industry, The British Thomson-Houston Co., Ltd., invited the technical Press to a symposium and an exhibition on industrial electronics, held at their Rugby works. The symposium was ably organised by the company's Electronics Engineering Department, whose activities include the development of radar navigational aids for merchant ships, and electronics engineering associated with research into nuclear physics.

This field is now considered as of importance to all industries, and after the war-time interruption in industrial research work, which necessitated the transfer of the engineering personnel to tasks directly connected with the war, the company intends to proceed with developing its industrial electronics activities on a substantial scale. The progress achieved during the last six years in the development of valves for factory use has made it possible for the company to state that "electronics can now perform functions impossible by other means": it is particularly suited where high speed of operation, precision of control, and the ability to operate for long periods, are essential. Although allowance has to be made for the inevitable progress in alternative methods, there is reason for optimism about the future of electronics in industry.

To mention some of the main applications of B.T.-H. electronics equipment, a wide field exists for the control of motors and generators, while the electronic control of resistance welding has already been established as a specialised line of the company. It has proved valuable during the war for the welding of aluminium alloy parts for aircraft, and several millions of standard gallon petrol cans were seam- and spot-welded by B.T.-H. electronic controls. This method has enabled certain metals and alloys, hitherto considered incapable of being welded, to be welded with ease; moreover, it has permitted the welding of mild steels at considerably increased speeds, thus reducing manufacturing costs and accelerating production. At the same time, it has made possible the reproduction of welds of the highest quality, under normal factory conditions, by removing one of the chief sources of bad welds, *viz.*, variations in the length of the welding time.

Induction heating by high-frequency

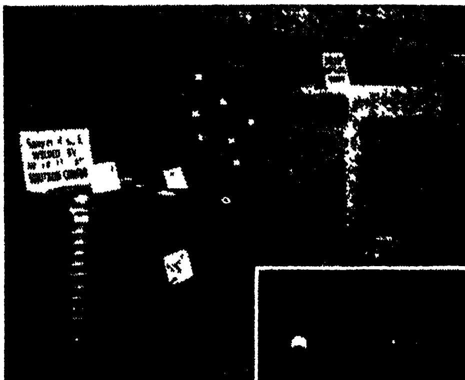


Fig. 1 (above). A corner of the B.T.-H. exhibition, showing samples of welded work produced by spot-welding with the aid of electronic control; also a typical spot-welding machine.

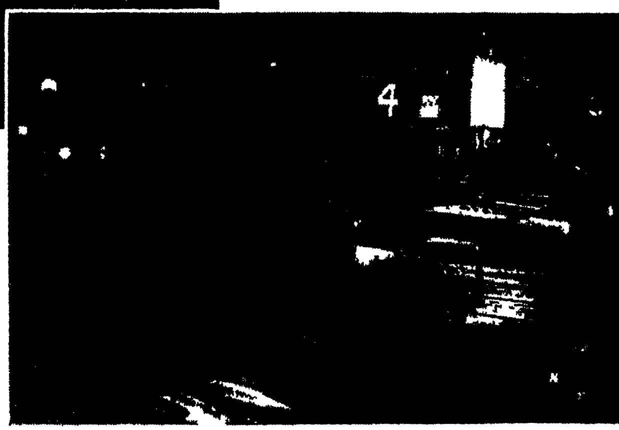


Fig. 2 (below). Spot-welding machine (390 kVA) engaged in welding aircraft parts in aluminium alloy. The Ignitron "Programme" control panel, which enables the value of the welding current to be maintained substantially constant, is seen on the left.

power produced by valve oscillators has been known for many years. However, more recently it has been adopted for the heating of larger masses of metal, covering such applications as surface hardening of gears, small shafts, etc., and through heating for annealing and brazing processes. Another field of application is the melting of special alloys, where highly accurate temperature control and strict cleanliness are desired. In the through heating of billets, preparatory to rolling, forging, or upsetting operations, the advantages of electronic control are obvious.

Dielectric heating, necessarily confined to non-metals, shows great promise for the preheating of moulding compounds. A valuable application is in the pre-heating of resin bonded moulding powder in loose or pellet form, while another well-established use is in the bonding of veneers to make plywood, or in making joints in furniture, using a thermosetting glue. Dielectric heating is also suitable for the removal of moisture in many industrial processes. An advantage, when removing moisture, is that the electrodes need not be in contact with the material, so that air may be blown over the work to remove steam, thus preventing flashover due to condensation. Finally, it can be made use of in the welding of thermoplastics, since spot or seam welds can readily be made in thermoplastic tubes and sheets.

In the Chemical Industry

The use of valves in the chemical industry has hitherto been very limited, and it appears that the manufacturers have not received any specific inquiries for the adaptation of their equipment to the needs of chemical plant, although it is averred that there is ample scope in an industry where accuracy, speed, and cleanliness are paramount. In the company's chemical research laboratories, development work is in progress on the use of silicones for insulators and it is hoped to produce silicone lubricating oils as a by-product. Work is constantly being carried out on the fluorescent coating of lamps, to give daylight or colour effects, while the production of layers for cathodes is yet another field of chemical activity which can be undertaken at the Rugby works.

Share in Britain's Recovery

In Britain's progress towards economic recovery, electronic control can play a large part; it can provide more accurate control, thereby eliminating the human element, and probably reducing rejects. Electronic instruments and relays provide the most promising method of eliminating inspection of finished or partly finished products. When, over ten years ago, B.T.-H. installed one of its earlier instruments in a certain company, labour troubles arose, because the workers saw that human control was being eliminated. Under the present conditions of labour shortage, and in view of the necessity of making the best use of the existing man-power, the position is somewhat different. The general acceptance of electronic control by industrial users is much more advanced in the U.S.A. than in this country, although both countries have approximately the same technical knowledge in this field. If British industry is to regain its position when to-day's sellers' market has given way to highly competitive conditions, it will be absolutely essential to supplement the range of standard articles by highly specialised goods, and in the manufacture of both, electronic control should play an increasing part.

Chemical Exports

Decline in Figures for June

As had been forecast, there was a fall in exports from the U.K. during June. The total value of exports, according to the Board of Trade monthly accounts, issued this week, was £65,000,000, which is just over £20,000,000 less than for May.

June had four fewer working days than May, including the V-day and Whitsun holidays, with consequent dislocation of production and transport, which clearly must have extended longer than the actual holiday period. As a result, the continuous rise in the rate of export since the beginning of the year was interrupted. Present indications are, however, that the export figure for July may well exceed the very good one for May.

Exports of chemicals, drugs, dyes and colours during June were valued at £4,439,576, which is £1,717,339 lower than the figure for May, but £1,283,932 higher than the figure for June, 1945, and £2,682,927 higher than the monthly average for 1938. The list of customers is again headed by British India, with purchases valued at £523,395, followed by Australia (258,088), and Sweden (£198,121). The total value of exports for the six months ended June 30 is given as £31,695,027, which is £15,251,235 higher than the figure for the like period last year.

Imports of chemicals, drugs, dyes and colours during June also showed a decline. The total value is given as £1,405,428, which is £423,062 less than the figure for May, and £474,376 less than the figure for June last year, but £271,037 higher than the monthly average for 1938. The U.S.A. was the largest supplier again, with goods valued at £282,756; Spain was second (£209,184); and the Argentine Republic third (£183,480). For the six months ended June 30, the total value of imports was £8,725,230, which is £2,729,667 less than for the corresponding period last year.

South African Chemical Notes

Review of Most Recent Developments

(from Our Cape Town Correspondent)

THE building controller in Johannesburg stated recently that the general situation in regard to cement was likely to become worse during the winter months, since the railways will be strained to the utmost in transporting increased coal requirements. The closing of a kiln in an Orange Free State factory, because of the water shortage there, also affected the supply, but the kiln had now been reopened, the recent rains having refilled the factory's dams. The unprecedented demand for cement in the building industry depleted the Union's existing stocks, and caused unavoidable delay in the building programme. Every effort was being made, however, to ensure a regular supply for the national housing scheme. Two large Transvaal factories are installing additional plant, and a new factory is being planned for the Lichtenburg district; but, until the railways are able to expand their rolling stock, there is little chance of the shortage of cement in South Africa being eased.

The curve of imports from Britain to South Africa is rising steadily and steeply. A trade expert in Cape Town, analysing the latest figures, said that, although perhaps in some ways Britain's export drive was not spectacular on the surface, what had been achieved was truly astonishing and augured well for the future. Chemicals. drugs, dyes and colours are arriving in South Africa from Britain in larger quantities than ever. The values of these goods imported per month in 1938 was £147,064, and in March this year they aggregated £406,650.

Imported cosmetics are now easier to buy in South Africa, but in this aspect of trade women say they are not being offered as many shades of make-up and as many varieties of scent as in pre-war days. In artists' materials there is still a famine, likewise in many types of imported paint, apparently owing to a lack of containers.

Linseed Oil Problem

There is danger of the South African paint industry being brought to a standstill by lack of linseed oil. Unless the Government succeeds in persuading the Joint Food Council in London and Washington to allocate supplies from South America, the industry will receive no more. This is the result of the stoppage by the Indian Government of all linseed oil exports to South Africa. It is believed that this action is due to shortages in India. Stocks of linseed oil in the possession of paint manufacturers, it is estimated, will carry them over the next few months, but if arrangements are not made to import from South America, the industry will be hard hit. By the end of the year it will be difficult to obtain supplies of paint for houses now being built.

Plant for the recently-established Capital Match Corporation, Ltd., is expected to reach the Union before the end of the year, and production should begin within three months after it arrives, said the chairman of the company at the recent statutory meeting. He said the company's initial output would represent about 12 per cent. of the matches consumed in the Union. A "quality match second to none" was aimed at.

True South African Venture

It was intended to get supplies from South African cardboard factories, and to use locally-made paper and so far as possible chemicals made in the Union. "There are no shareholders from foreign countries, and so it can truly be said that this is a true South African venture, and that all the benefits to be derived from the activities of the company will be for its South African shareholders," said the chairman. Requests from African territories indicated that there would be no difficulty in disposing of the company's products outside the borders of South Africa if they decided to enter the export market.

Recent improvements in production methods have enabled African Oxygen and Acetylene, Ltd., Victoria Road, Salt River, Cape, to reduce the standard price of dissolved acetylene. Since 1927 the company has reduced the price of dissolved acetylene by nearly 35 per cent. and that of oxygen by 60 per cent.

Pyrotechnic Industries of South Africa, Ltd., P.O. Box 322, Johannesburg, are a newly-established company which will manufacture fireworks—the first firm in South Africa to make them. The company is a division of Union Explosives and Engineering Co. (Pty.), Ltd., Elandsfontein, Transvaal. Overseas experts in pyrotechnics are in charge of the company's production. The range will include most of the familiar items.

Kemikon (Pty.), Ltd., 11 High Street, Fordsburg, Johannesburg, are manufacturing tyre paint in black and white, packed in one-pint containers.

First-rate South African writing inks hold the bulk of the local business, although a number of imported writing fluids—mostly advertised for use with fountain pens produced by their respective makers—have a regular sale. Mucilages appear at long last to have passed the experimental stage,

and the prejudice against the locally-made article, which existed for several years, seems now to have gone.

After visiting most of the food factories in South Africa under the auspices of the British Ministry of Food, Mr. R. A. MacDonald, a representative of Balfour, Williamson & Co., Ltd., London, who have considerable interests in the canned food industries in the United States and Canada, considers that factories in the Union compare favourably with the leading factories in California, Florida, and Canada. Mr. MacDonald said that South African factories were equipped with the most modern machinery, and that the quality of locally made jams, canned fruit, and canned vegetables was uniformly high.

A director of a local graphite company returned to South Africa recently from a visit to the United States. He said he had arranged for large shipments on a regular basis, American industrialists being impressed by the quality of South African graphite. At present the company was exporting to Australia, the Argentine, Egypt, Palestine, and Turkey. The company planned to expand in the near future, and had acquired four acres of land at Krugersdorp for a new factory.

Paints and varnishes are to be manufactured in the Union by African Explosives and Chemical Industries, Ltd., an associated company of I.C.I. It has also been announced that the local company would undertake the manufacture of cyanide, leather cloth, and probably chemicals, " in accordance with the policy of developing secondary industries in the Union."

It was recently moved in the House of Assembly that the Government should consider the establishment of an indigenous oil industry. It was pointed out that the Union's coal reserves are estimated at 250,000,000,000 tons, which, at the present rate of consumption, will last 20,000 years. Apart from the problem of coking coal, therefore, the necessity for conserving fuel supplies does not arise. The point is, rather, how to derive maximum advantage from natural resources with which few parts of the world have been so generously endowed. It cannot be said that hitherto this vast potential asset has been accorded the attention it deserves. Coal as a source of steam and electric power has made possible the mining and industrial expansion of the Union. Its by-products are already playing an important part in the economic structure, but the potentialities for their further exploitation remain enormous. In particular, one enormous field is still untapped, namely, the oil reserves contained in the country's vast deposits.

Industrial Spectroscopy

The 1946 Conference

(from Our Analytical Correspondent)

IT is some years since Twyman[1] made his plea for the formation of a Spectrochemical Society or a section of one of the existing societies dealing with industrial spectroscopy. This plea was supported in these columns at the time.[2] Developments along these lines were naturally retarded by the war, but the need for some such body was frequently underlined by the rapid strides made, immediately before and during the war, in spectroscopic fields of analysis. It was therefore with interest that we learned, early in this year, of the formation of the Industrial Spectroscopy Group of the Institute of Physics, with Mr. Twyman as its first chairman. At the recently held first conference of the Group, on Recent Developments in Industrial Emission and Absorption Spectroscopy, a wide range of topics was discussed.

The first session of the conference concerned itself with infra-red absorption spectroscopy. H. W. Thompson, introducing the topic by his address on the Use of Infra-Red Spectroscopy in Analysis, dealt in turn with the origin of infra-red spectra, their nature, and, finally, their use in analysis. Both qualitative and quantitative applications were considered, and many problems which could only or best be solved by using these methods were rapidly surveyed. Where such mixtures as the cresols or the xylenols are concerned, infra-red investigation is invaluable. In one instance, for example, where the speaker was set an "examination" by a doubting inquirer, he was able to state that the unknown delivered to him only contained 90 per cent of the substances which he was asked to determine. It transpired that 10 per cent. of inert material had been added, just to see what would be reported. Fortunately, the speaker said, they had decided not to " cook " their results!

The second paper of this session was a detailed description, by G. F. Lothian, of Equipment for Infra-Red Absorption Spectroscopy. Instruments for producing and recording spectra with varying degrees of resolution were described in some detail. A useful comparison of American apparatus and the corresponding instruments available

[1] THE CHEMICAL AGE, 1940, *43*, 48.

[2] MASTERS, THE CHEMICAL AGE, 1941, *44*, 231.

in this country was made. In the discussion which followed, new optical materials perfected by Germany during the war were described, among other topics.

Emission Spectrography

The second session of the conference was devoted to emission work, and was introduced by a paper by A. S. Nickelson and F. W. J. Garton on Modern Equipment for Spectrographic Analysis. Qualitative analysis by emission methods is now, it was explained, a simple matter, and the method is common, so that no detailed discussion of it was offered. Quantitative analysis as applied to the determination of trace elements or minor constituents is also well established, and using the ordinary apparatus may be expected to show an accuracy equivalent to that of ordinary chemical analysis when applied to comparable amounts. However, quantitative analysis for major constituents is a different matter, and it is primarily with the apparatus which enables this to be undertaken that the paper was concerned.

In the first place, samples must necessarily be homogeneous, and it is essential that samples chosen for repeat operations should be identical. As source, the direct current arc was the first to be developed, and where sensitivity is the prime consideration it is probably still the best. However, its very nature gives rise to inaccuracies, particularly with regard to reproducibility for quantitative work. Consequently for such determinations the a.c. condensed spark found increasing application. It has high reproducibility and can be used for materials with low melting-points. On the other hand, its sensitivity is relatively low.

More recently there have been introduced the high-voltage alternating current arc and the low-voltage interrupted alternating current arc. The latter gives high reproducibility, but probably has not, up to the present, been used with a sufficiently high current density, a maximum of 4 to 5 amps. being most used.

Finally, there is the so-called multi-source unit, which gives discharges capable of continuous variation from arc-like to spark-like, according to the demands of the analysis.

The spectrograph employed may either be quartz or grating. The medium quartz instrument is suitable for non-ferrous metals, the large quartz instrument being demanded for the more complex spectra of transition elements. Even this does not, on occasion, give sufficient dispersion, particularly if the visible region is required, and in such cases recourse must be had to the grating instrument, which may give as much as three times the dispersion in the visible region with the first order spectrum. Of grating instruments the most usual are those employing the Rowland mounting, which requires rather a lot of space, or the Eagle mounting, which replaces the prism in a large quartz spectrograph of the Littrow type by a grating. Such spectrographs, in their turn, raise new optical difficulties.

For recording the spectra one may employ either photographic or photometric, *i.e.*, direct-reading methods. In photographic work it is probable that films give better results than plates, since, so far, emulsions specially designed for spectrographic work have not been made available. Direct photometric measurement, recently coming to the fore in America, should receive more attention in this country than it has done, since it is capable of being carried out with a *lower* personal factor than photographic recording.

Identification of Spectrum

Finally, if the spectrum has been recorded photographically, it must be identified, and the appropriate lines measured for density photometrically. For identification, the Judd-Lewis Comparator is still the best available instrument. Photometry of the lines after identification must be carried out with considerable care, since it may give rise to serious errors if not properly handled.

The second paper of this session, by A. Walsh, dealt with Light Sources for the Spectrographic Analysis of Metals and Alloys. The d.c. arc and the logical development of other circuits from this were discussed, the simple condensed spark being first described, and then the other circuits which had been considered in the previous paper. It was clear from the paper that much further work is necessary before the exact factors controlling the nature of a discharge and its reproducibility are fully known and understood. Investigation of discharges, both by high-speed photography and by the oscillograph, has given valuable information in this direction.

The final paper of this session, by H. T. Shirley, presented a Statistical Examination of Sources of Error in the Spectrographic Analysis of Low-Alloy Steel.

In the discussion arising out of these papers, several speakers gave further contributions, from their own experience, on the apparatus and methods described.

If one were to voice any criticism of this excellent conference, it would be the impression that was given that no work was being done in the field of absorption spectroscopy in the ultra-violet. It is quite probable that this impression was completely unintentional, but it nevertheless existed. There is always a tendency for new methods to overshadow the older, but still very useful ones. It is to be hoped that the rapid rise to popularity of infra-red work will not conceal the fact that important work can also be done in other regions.

Chemical Engineering

Need for More Men in the Profession

THERE is a very marked expansion at the present time of those industries which are mainly concerned with some chemical process for their development. So great is the demand for chemical engineers that the Institution of Chemical Engineers, in conjunction with the Institute of Petroleum, the Association of British Chemical Manufacturers, and the British Chemical Plant Manufacturers' Association, recently addressed a memorandum to the Government, calling attention to this remarkable development and at the same time emphasising the very great shortage of trained chemical engineers in this country compared, for example, with America. The number of students studying in a year for a degree in chemical engineering is at present about 40 in Britain, compared with 3000 in the United States.

Proposed Courses

The Government, having taken full information on the subject, has responded to this approach, and is proposing to establish courses in chemical engineering for those who already have a chemistry, physics, or engineering degree. This has been decided as a short-term policy in order to train chemical engineers to meet the demand, which, at present, is more apparent on the plant manufacturing side, as many proposed improvements and developments had to be postponed until after the war. While, therefore, there is a special demand for men to design and erect such equipment, there are also big requirements for chemical engineers in the industries using plant. The value of well qualified chemical engineers is now fully recognised in industry, and in many companies the highest executive posts are open to people of the right calibre.

There are, first, the chemical industries making materials such as sulphuric acid, washing soda, bleaching powder, all of which are used in ever-increasing quantities. Compounds such as these are often used to indicate the state of the chemical industry as a whole owing to the widespread demand for them for intermediate stages in manufacture. In the petroleum industry, for example, there are developments in the chemical treatment of petroleum compounds to give high-octane fuels for aviation, synthetic rubber and a whole range of solvents for lacquers, etc. In the field of atomic energy, the problems involved in the separation of the active constituents from the ores, and the separation of these into isotopes under remote control, require chemical engineering of a high order. On the pharmaceutical side, modern drugs such as the sulphonamides, the substitutes for quinine, and materials such as penicillin, call for entirely new techniques for their manufacture.

The modern developments in textiles are in the direction of artificial fibres which seem destined to be the basis of cloths likely to be superior to many of those produced from natural fibres. The chemical processes and plant and machinery required to produce such a substance as nylon are so intricate as to involve a considerable knowledge of organic chemistry to understand what is happening in the plant. If a chemical engineer does not realise what he is making, it is very difficult, if not impossible, to suggest improvements leading to better yields and more economic operation. The plastic industry is ever expanding. New materials, such as the polyvinyl chlorides, are still being discovered and developed. Considerable skill is required to ensure production to a constant specification. On the agricultural side, there is an ever-increasing demand for all types of fertiliser. The equipment needed to convert the nitrogen from the air and hydrogen from steam into ammonia for fertilisers calls for very high pressures and a detailed knowledge of strength of materials and their resistance to corrosion.

Other Openings

The present low output of coal makes it essential that heat and fuel should not be wasted. The chemical engineer is trained to use fuel economically and to be able to rectify avoidable heat losses. The gas industry is being reorganised on a national basis and the tendency now is to regard coal as much as a raw material for chemical industry as a fuel. In the oils and fats industry new developments are taking place in the improvement of margarine. Continuous methods for the manufacture of soap call for very ingenious methods of plant control, design and operation, and give possibilities of separation of fatty acids for use for other purposes and for selection according to the particular qualities of the soap required. Other industries, such as glass, ceramics, building materials, metal, explosives, dyestuffs, paint, rubber, leather, glue, starch, sugar, fermentation, photography, and essential oils (to mention only some) all require more chemical engineers and chemical plant.

Whereas it has formerly been customary to train candidates for a specific industry, it has now been found that a more fundamental training is possible, so that the graduate is equally fitted for any of the chemical industries mentioned. This is achieved partly by the concept of unit

operations, such as filtration, evaporation, drying, absorption, leaching, etc., because it is found that all these operations enter in some form or another into the process industries and that the principles underlying them are therefore equally applicable to all those industries with slight modifications to suit local conditions.

The details of the degree course have been set forth by the Institution of Chemical Engineers in a brochure entitled: Scheme for a Degree Course in Chemical Engineering. The fourth year of this degree course corresponds roughly to the post-graduate courses now being organised. The exact training which the students receive will depend to some extent, of course, on their previous knowledge and will be designed to enable them to approach the chemical engineering course proper with sufficient background in the general principles of chemistry and mechanical and electrical engineering.

The prospects for chemical engineers are equal to those in any of the highest-paid professions, both as to interests and remuneration. Starting salaries for qualified chemical engineers are good. On the purely technical side many openings lead to four-figure incomes, while for those who show administrative ability the prospects are no less excellent. In both cases there are eventual possibilities of seats on the board of important plant and manufacturing companies. Readers who are interested and would like to have further information are invited to write to the Ministry of Labour and National Service, Technical and Scientific Register, York House, Kingsway, London, W.C.2, and ask for Leaflet P.L. 126.

A CHEMIST'S BOOKSHELF

AQUEOUS SOLUTION AND THE PHASE DIAGRAM. By F. F. Purdon and V. W. Slater. London: Edward Arnold. Pp. 167. 24s.

It is doubtful whether this book will have the whole-hearted approval of theoretical chemists, but we have no doubt of its welcome from the practical chemist and chemical engineer. It contains the minimum of theory and the maximum of practice. Its minimum of theory is indeed so small that if it were not for one short chapter at the end, which summarises the theoretical explanation of the phase rule, it might be said to contain no theory in the sense that that much misused term is generally applied. The book deals with phase diagrams and their application to aqueous solutions. It is intended to serve as an introduction to the use of phase diagrams and ultimately as a laboratory manual, or desk companion, for those workers who wish to apply this method for the solution of problems of heterogenous equilibria.

The authors believe that if it were more generally realised that the phase diagram could be used to solve practical problems without much advanced knowledge of the theory of the phase rule, the use of the phase rule would be very much more general and the chemical industry would benefit accordingly. This book, therefore, concentrates upon the practical construction and interpretation of diagrams from the point of view of elementary geometry and arithmetic. It is an eminently practical book and we predict that since its explanations are simple and understandable, it will prove of immense value both to chemists and chemical engineers, who are finding that the specialised knowledge required of them is beginning to be greater than the capacity of the human brain. The general terms are explained and illustrated by a simple 2-component diagram such as the system ammonium sulphate—water, or, the more complex 2-component system, sodium iodide-water. The practical applications of this simple type of diagram to crystallisation, the purification of crystals, the desiccation of crystals and other common operations is described, thereby illustrating how the diagram can be used without requiring anything more than a knowledge of the terms employed. An explanation of the use of triple co-ordinates is followed by the interpretation of three-component diagrams, and a further chapter dealing with the practical application of these diagrams. At this stage, the authors digress for a chapter to consider how solubility is determined for building up the phase diagrams. They then plunge into the more complicated diagrams of systems possessing more than one component; a chapter on the reciprocal salt pair, for example, in which the points must be represented on a pyramid, is explained by examining the system: Na_2SO_4-NaCl-KCl-H_2O. The salt pair diagram is then applied to evaporation to show how it is used in practice. A difficult chapter, which the reader is implored in the preface not to "skip," is on Jänecke's projection, which assumes that a shadow is cast from a point of light situated at the apex of the pyramid, the eye being placed at the apex and thus viewing the figure from a distance; a long chapter is devoted to practical examples of projections using this method. Finally, the authors discuss the five-component system of four salts and water, and (as previously stated) end with a brief account of the theory of the Gibbs Phase Rule.

As a practical working manual of the use and application of the phase rule, this is one of the best books we have encountered. It can be recommended to all those who wish to use one of the most important tools that physical chemistry has given us.

LETTERS TO THE EDITOR

A Tribute from U.S.A.

SIR,—Your editorial, "A Type of Research We Haven't Got," appearing in the May 18, 1946, edition of THE CHEMICAL AGE, has been called to my attention because it describes Battelle Institute and points out how it and other similar institutions might well be copied in England.

I am pleased indeed by your editorial, not only because Battelle Institute is mentioned as a pattern for a research organisation, but also because of your excellent plea for a system of scientific research outside of political control.

Congratulating you on this well-written editorial, I am.—Faithfully yours,

CLYDE WILLIAMS,
Director.

Battelle Memorial Institute,
Columbus, Ohio.
July 3, 1946.

Superphosphate Manufacture

SIR,—May I direct your attention to an error which arose in my article on "Superphosphate Manufacture," published in your issue of June 22. The last lines of the first paragraph should read: "the calcium sulphate was present as anhydrite, $CaSO_4$."

It will be recalled that in 1926, believing that the calcium sulphate in superphosphate is present as gypsum, $CaSO_4.2H_2O$, I endeavoured to remove the water of crystallisation, in the hope of obtaining a product of higher phosphoric acid content. I then found, probably for the first time, and contrary to general belief, that the calcium sulphate was present as anhydrite, $CaSO_4$.

In manufacturing phosphoric acid it is possible to produce any of the three crystal forms of calcium sulphate, namely, $CaSO_4.2H_2O$; $CaSO_4.\frac{1}{2}H_2O$; or $CaSO_4$. But the last form only can be obtained when manufacturing calcium superphosphate.—Yours faithfully,

SVEN NORDENGREN
Landskrona, Sweden, July 22, 1946.

FRENCH IMPORT CHANGE

Modifications in their arrangements for importing goods into France were recently announced by the French authorities in the *Moniteur Officiel du Commerce et de l'Industrie*. Imports are in future to be obtained through three different channels, namely (a) the French Purchasing Mission buying on Government account; (b) import groups; and (c) private traders importing under licence. Detailed lists of the chemicals to be obtained through these media are given in the *Board of Trade Journal* for July 20.

Inert Spindle-Oil

Prevention of Spinners' Cancer

A PAPER of great importance to the cotton industry has been published by the Manchester Oil Refinery, Ltd., Adelaide House, London, E.C.4, and Trafford Park, Manchester. It deals with mule spinners' cancer and has been distributed to all executives in the Lancashire cotton industry. It urges the use of non-carcinogenic, non-dermatitic spindle-oils, a supply of these, with high lubricating and stainless qualities, being now available.

In the latest available annual report of the Chief Inspector of Factories (for 1944), details of which were published in THE CHEMICAL AGE on December 8 last (1945, 52, 533), a marked increase in the incidence of epitheliomatous ulceration was recorded—205 cases, of which 20 were fatal, as against the 1943 figure of 160, with 15 fatal. Of the 20 fatal cases, 17 were attributable to mineral oil, all of them being among cotton operatives. The vital importance of the development and use of a non-carcinogenic spindle-oil thus becomes obvious.

Improved Lubrication Properties

As long ago as 1937, the booklet explains, C. C. and M. J. Twort had proved that oils of vegetable and animal origin, and colourless mineral oils, produced up to certain standards by special chemical processes, were free from carcinogenic constituents. Previously, one of the main difficulties in applying normal colourless mineral oils to mule spinning was their inadequate lubricating power. However, the recommendation of the Tworts was eventually taken up by the Manchester Oil Refinery, Ltd., and the company produced "Puremor" spindle-oil and other white oils of non-carcinogenic quality, which incorporated the work of lubrication technologists and provided an oil that was not only safe and biologically inert, but had improved lubrication properties showing a drop in "bolster" temperature of up to 70°F. over old-type mineral oils.

Although the cost of these oils is higher per gallon than the old types, the fitting of anti-splash devices, resulting in a considerable saving in lubricant consumption, renders the final cost per gallon actually lower. For anti-splash devices it is claimed that it is necessary to lubricate the spindles as little as once a week, or even once a fortnight, against the usual twice daily oiling with normal-type spindle-oils. Even if the cost had been higher, it is felt that such a factor should not be taken into consideration when the possibility of eliminating mule spinners' cancer is envisaged.

The Distillers Company

Chairman's Address at the Annual Meeting

THE 69th annual general meeting of the Distillers Company, Ltd., was held in the North British Station Hotel, Edinburgh, on July 19, when the chairman, Lord Forteviot, O.B.E., M.C., D.L., presided. The following is an excerpt from his address to stockholders:

The consolidated profit and loss account discloses that the total profit earned by the group, after charge for excess profits and overseas taxation, amounted to £6,914,330 and, adding the other revenue and miscellaneous receipts, the total is £7,781,312 After making full allowance for income tax, adding to superannuation and sundry reserves in the books of subsidiary companies, and providing for dividends to outside shareholders, there remains £2,574,760 as the sum available to the company, compared with £2,173,718 for the previous year. The amount applicable to the Distillers Company, Ltd., but retained by the subsidiary companies is £103,920, as compared with £187,262. The board has applied to general reserve £650,000 (making it £4,650,000), leaving available with the amount brought forward, and after deducting directors' fees and interim dividends, the sum of £1,867,586 as against last year's figure of £1,621,842.

It is proposed to pay a final dividend on the ordinary stock of 12½ per cent. less income tax (making 20 per cent. less income tax for the year) and a special dividend on ordinary stock of 2½ per cent. less income tax, thus leaving to be carried forward £591,654 as against £555,815 brought in.

The Balance Sheet

Turning now to the legal balance sheet, I have to make reference to the following matters of interest:—

(1) The capital reserve has risen during the year by £487,611 to £828,812. This has been caused first, by the liquidation of a subsidiary company with the release of its reserves, and secondly, by the realisation of certain investments at a profit.

(2) The market value of the company's quoted investments is substantially in excess of the book value, as is shown by the notes on the face of the balance sheet. The unquoted securities are at values that are considered by the board to be satisfactory.

(3) During the year the company purchased for cash a holding of 60 per cent. of the issued share capital of Thos. Borthwick (Glasgow), Ltd., grain merchants, etc., Glasgow. This has enabled the company to centralise the purchase of cereals and the sale of by-products. Under the agreement preferential consideration is to be given for a reasonable period to those grain merchants from whom substantial purchases of cereals were made before the outbreak of war.

(4) Stockholders will remember they were informed that with the view to extending its plastics manufactures, the company, in conjunction with the B. F. Goodrich Chemical Co., of Cleveland, Ohio, had promoted a private company, incorporated in England, under the title of British Geon, Ltd., with a capital of £500,000, consisting of 225,000 5 per cent. preference shares and 275,000 ordinary shares, all of £1 each. The company's holding is 55 per cent. of each class of share. The primary object of the new company is the manufacture of polyvinyl chloride and co-polymers. The chairman of British Geon, Ltd., is Sir Walrond Sinclair, K.B.E., chairman of British Tyre & Rubber Co., Ltd., and of United Glass Bottle Manufacturers, Ltd.

(5) As it has not been necessary to draw on the war contingencies reserve for any of the purposes for which it might have been required, the board has decided to transfer the amount at credit thereof, £250,000, to the general reserve, bringing it up to £4,900,000.

(6) No account has been taken of E.P.T. post-war credits, but it is estimated that these will total over £1,500,000, giving the group, after deduction of income tax, an amount in excess of £825,000, which, of course, will be credited to reserve to meet part of the development and re-equipment expenditure.

(7) The provision for deferred repairs amounted at May 15, 1946, to £260,000, and all of this has been earmarked to meet repairs, etc., held up on account of war conditions.

Addition to Provident Funds

While I do not need to comment in any great detail on the consolidated statement of assets and liabilities, it is important to note from this that the current assets amount to £53,205,225 and current liabilities and provisions to £10,053,733. The surplus applicable to the members of The Distillers Co., Ltd., exclusive of the reserve for taxation not yet due, is entered as £17,783,693. Once again substantial appropriations have been made out of group profits for credit to the superannuation and provident funds, making the total of these £3,637,173 at May 15, 1946.

The conservative financial policy adopted by the Board over a fairly long period of years, with the continued "ploughing back" into the business of a substantial portion of the profits earned, while writing down fixed assets, such as land, buildings,

and plant, to what to-day might be termed nominal values, has enabled the board, after a full exploration of the company's position, to be a little more generous on this occasion to the ordinary stockholders. At the same time the appropriation to general reserve has been increased by £150,000, while the carry-forward is £35,839 higher. To mark the end of the war, and as a token of appreciation of the services rendered throughout the war years, the board has decided also to grant a special cash bonus to every employee in the group who, at June 30, 1946, had a minimum of six months' service. The maximum period for the purpose of calculating the bonus will be six years, and time with the Forces will count. It will be granted to all who are qualified—whether director, official, or salaried or weekly wage-earner—and while it will be on a generous scale it will not be extravagant. The board is confident that this gesture will have the unqualified approval of stockholders.

It will be apparent, from a study of the accounts, that the position has been reached where the net assets of the group, even at balance-sheet values, are much in excess of the issued share capital. The board has given careful consideration to this aspect, but at the present time it is not possible to obtain permission to re-organise the capital structure.

Distilling

At this time last year we were hopeful of a return to full potable distilling, but this did not materialise. The Ministry of Food confidently anticipated being able to allot to the industry sufficient cereals to enable production on a pre-war scale to be resumed during the season 1945/46. They adopted a cautious policy, however, and issued only a portion—about 43 per cent.—of the licence to begin with, the intention being to release throughout the year the additional quantity. Unfortunately, this good intention was not realised for reasons well known to all. The spectre of famine has reared its head throughout various parts of the world and the position now is that until the results of the next harvest are known, the board feel they cannot press their claims further at this stage.

The malt distilleries have already completed their quota and are closed down, while the grain distilleries expect to complete theirs by the end of the summer.

Yeast

The voluntary scheme of zoning, to which I made reference at this time last year, and the profit control scheme, continued during the year under review. These have now terminated with effect from June 1, 1946. At the same time the Ministry of Food has withdrawn the subsidy arrangement under which yeast manufacturers, during the war period, received molasses, their basic raw material, at a price considerably below cost to the Ministry. The withdrawal of the subsidy has resulted in a revision of the price of yeast to the trade, but the Ministry has satisfied itself that no unwarranted rise in price has taken place.

Throughout the year the demand for the company's bakers' yeast and yeast-products has continued to increase. While improved processes have been introduced, and efficiency has been maintained, stockholders will be interested to know that plans are in course of preparation for the erection of a modern factory to operate the latest improved processes. It is hoped, in due course, that the company will obtain approval, and the necessary licenses, from the appropriate authorities to enable a start to be made in the construction work.

Industrial Group

Last year I gave stockholders a broad outline of the company's wartime activities in the chemical and plastics fields, and it will probably suffice to say now that we are closely following the needs of those sections of the industries in which we are concerned. Serious problems and delays are involved in the delivery of certain necessary raw and constructional materials, but nevertheless extensive development work is in hand, involving considerable financial outlay, with the view to covering the expansion of supplies for present day and future market requirements.

Under existing abnormal conditions it is still difficult to measure accurately the effect of the withdrawal of the excise allowance on industrial alcohol, but the company is closely engaged in preparing for alternative raw materials, which, it is hoped, will provide a solid foundation on which to base the range of chemicals and plastic materials with which it is concerned.

As I foreshadowed last year, the board, after full consideration, is proceeding with extensions to our central research station, and, in addition, is providing the principal yeast and yeast-products, and chemical and plastics sections, with out-stations fully equipped with facilities for conducting short-term research and pilot plant work. These services are considered an essential and complementary part of the general expansion in our manufacturing programme.

Future Prospects

Turning now to the future, while the further delay in the resumption of a full programme of potable distilling brings renewed anxiety, in other respects, and particularly in the strong financial position of the group, there is good reason to look forward with quiet optimism and confidence.

The report was adopted.

Parliamentary Topics

Steel Consumption

IN the House of Commons last week, Sir Waldron Smithers asked the Minister of Supply what were the facts which formed the basis that home consumption of steel would be 13,000,000 tons, and exports 3,000,000 tons in 1955, considering that the mean curve from 1910 to 1945 included two wars, during which steel production was abnormally high.

In reply, Mr. Wilmot said he assumed that Sir Waldron was referring to the estimate made by the British Iron and Steel Federation in their recent report which was published as a White Paper. The estimate of home consumption at 13,000,000 ingot tons a year assumed full employment, and had regard to the long-term upward trend of steel consumption in all industrial countries. The estimated export of 3,000,000 ingot tons was based on the potential world demand and the changes in the supply position.

Export of Steel Tubes

Sir Stafford Cripps, in reply to a question by Mr. K. Pickthorn, stated: "Exports of steel tubes are limited by the overall amount of steel for all purposes which can be made available for export. So far as the allocation of steel to the Board of Trade is concerned, the proportion available for the production of tubes for export has been agreed with the industry."

Linseed Oil for Linoleum

Sir Stafford Cripps, answering a question by Mr. Prescott, stated that the allocation of linseed oil to the linoleum industry in August would be maintained at the current rate. Future allocations would be determined in the light of the latest information about the supply position.

Argentine Linseed Oil

The Minister of Food, replying to a question by Major Legge-Bourke, stated that a small quantity of linseed oil had been shipped for UNRRA from Argentina. He was aware of no other purchase either of linseed or linseed oil for export from that country in the past three months. Negotiations were still proceeding in the matter of obtaining further supplies of linseed from the Argentine for this country.

West African Ground-Nuts

Mr. George Hall, replying to a question by Mr. J. Morrison, stated that the latest position in regard to the 1945 West African ground-nut crop was shown by the following figures (all of which represent tons): Purchases for export, 330,000; shipments to July 6: U.K., 147,556; Canada, 17,531; Norway, 4771; Denmark, 5755; Holland, 8256; Belgium, 776; total, 184,645; stocks on hand in West Africa on July 6, 145,355. Mr. Hall explained that those figures, which had been converted into decorticated weight where necessary, related only to ground-nuts bought for export.

Metalliferous Mining

Mr. Gaitskell, replying to a question addressed to the Minister of Fuel by Commander Agnew, stated that Lord Westwood had accepted an invitation to act as chairman of a committee of inquiry into the metalliferous mining industry. It was hoped that the full constitution and terms of reference of the committee would be announced soon.

Raw Materials for Plastics

Mr. Gallacher asked the President of the Board of Trade whether he would consider reducing raw material for plastic products that were only marketable because of a shortage in cotton goods, in order to increase supplies for the maintenance of the staple plastics industries.

Sir Stafford Cripps replied that the plastic products which were being marketed as alternatives to certain textile goods were made from polyvinyl chloride. Discussions on its distribution were taking place with the producers and users in the plastics industry, and steps had already been taken to ensure adequate supplies for the more important purposes. Sir Stafford replied: "Certainly," when Mr. Gallacher asked him to see to it that supplies of raw material were available to keep going a plastics industry in Scotland which was threatened with closing down.

FERTILISERS IN HOLLAND

The Dutch farming community is reported to be highly dissatisfied at the extremely slow rate of potash supply from the British and American zones of Germany, as Dutch horticulture is much in need of chlorine-free potash salts. While some 30,000 tons of potash should have come from Germany —a source on which Holland used chiefly to rely (apart from Spain)—at present nearly all supplies are coming from Alsace, which is to supply 50,000 tons under the new commercial treaty. Meanwhile, the French potash output is reported to have reached 285,000 tons in June, as compared with a monthly average of 223,000 tons at the beginning of 1946, and it is hoped that the figure will attain 340,000 tons in July. The nitrate plant of the Dutch State Coal Mines at Lutterade is working below capacity, while other plants were dismantled by the enemy. The Dutch superphosphate industry, however, having escaped serious war damage, should do well, provided that adequate supplies of rock and sulphuric acid can be obtained.

Personal Notes

MR. J. W. PEALING has resigned from the board of British Emulsifiers, Ltd.

MR. H. R. FRANCIS has been appointed joint managing director of Lacrinoid Products, Ltd., with Mr. H. E. Baum.

DR. FOSTER D. SNELL, who was chairman of the American section of the Society of Chemical Industry in 1944-45, has been elected president of the American Institute of Chemists, in succession to Dr. Gustav Egloff, the distinguished petroleum chemist.

DR. D. F. TWISS, D.Sc., F.R.I.C., who after 32 years as chief chemist to the Dunlop organisation, has just retired, has achieved a world-wide reputation as an expert on rubber and has played a great part in the scientific development of the industry. Among

Dr. D. F. Twiss.

his outstanding achievements is the discovery of the use of zinc isopropyl xanthate as a rapid accelerator for vulcanisation Another of his discoveries is the use of metallic oxides, especially zinc oxides, in the presence of organic accelerators of vulcanisation, which not only enables the combination of rubber and sulphur to take place more rapidly but produces stronger and more elastic rubber. In 1934 the Institution of the Rubber Industry awarded him the Colwyn Gold Medal for his scientific contribution to the knowledge of rubber.

Before joining Dunlop, as their first scientist, in 1914, Dr. Twiss was a lecturer in chemistry at Birmingham Technical School, which is now Birmingham Central Technical College. He was trained at Mason College, Birmingham, and was placed first on the roll of undergraduates when the college became the University of Birmingham as a result of the activities of Joseph Chamberlain. He holds research degrees of London and Birmingham Universities. He is joint author of " A Textbook of Inorganic Chemistry " dealing with the chemistry of sulphur and oxygen, and " A Course of Practical Organic Chemistry." He is vice-president of the Institution of the Rubber Industry, past member of the Council of the Royal Institute of Chemistry (his fellowship dates from 1908), and past chairman of the Midlands section of the Society of Chemical Industry.

LIEUT.-COLONEL E. BRIGGS, chairman of Lever Bros. (Port Sunlight), Ltd., since 1938, is relinquishing that position at the end of the year, when he is retiring. He will be succeeded by MR. G. A. STOKES NAIRN, who is now at Unilever House, London.

MR. T. MAY SMITH, who has retired from the board of A. Boake, Roberts & Co , Ltd., after being a director for 30 years, had been with the company for 41 years. MR. G. BUCK, MR. F. H. MACKENZIE, and MR. F. WILKINSON have been appointed to the board.

MR. A. W. MARSDEN, A.R.I.C., who is lecturer in the Department of Agricultural Chemistry at Imperial College, has been appointed head of the Chemistry Department at Seale-Hayne Agricultural College, Newton Abbot, in succession to Dr. E. Vanstone, who is retiring after holding that position since 1918.

MR. WILLIS M. COOPER, B.Sc., who has been transferred from the St. Louis office of the Monsanto Chemical Co. to the London office of Monsanto Chemicals, Ltd., will be assistant and project chemical engineering adviser to the managing director. During his eleven years with the Monsanto Chemical Co. he has been, in turn, analytical chemist, control chemist, production supervisor, development engineer, area supervisor, and process engineer.

MR. J. C. HANBURY, A.R.I.C., who has been appointed vice-chairman of Allen & Hanburys, Ltd., became a junior director in 1933 and technical director in 1943. A member of the executive of the British Pharmaceutical Conference and of the council of the Wholesale Drug Trade Association, he represents the firm in the Association of British Chemical Manufacturers and the Association of Malt Products Manufacturers.

Obituary

MR JOHN EDWARD SAUL, F.R.I.C., has died at West Wittering, Chichester, in his 85th year.

MR. FREDERIC WILLIAM JOLLYMAN (76), whose death has occurred at Keynsham, near Bristol, was chief chemist of the Imperial Tobacco Co. until his retirement just before the war. He had been with the company more than 40 years.

General News——From Week to Week

Penicillin is shortly to be made available for use by veterinary surgeons in the treatment of diseases of dairy cattle.

The paraffin oil priority scheme will continue to operate as hitherto for a further twelve months beginning August 1.

Crewe Hall, regarded as one of Cheshire's finest Elizabethan mansions, is being leased by Calmic, Ltd., manufacturing chemists, together with part of the park.

Gall nuts will no longer be imported on Government account, according to a Board of Trade announcement. Future imports will be through normal private trade channels.

A revised edition of *Wood Preservatives,* by N. A. Richardson, B.Sc., A.R.I.C., has been published by the Department of Scientific and Industrial Research and is obtainable from H.M. Stationery Office, price 6d.

A trade agreement for the exchange of goods to the value of £500,000 on each side has been signed by Great Britain and Rumania, whereby Great Britain will supply chemicals, machinery and leather in return for timber.

The Control of Iron and Steel (No. 51) (Scrap) Order, 1946 (S.R. & O., 1946, No. 1101), which comes into force on July 29, increases the maximum prices of iron and steel scrap to meet the recent increase in rail freight rates. The increases vary from 5d. to 1s. 6d. a ton according to district.

Imperial Chemical Industries have taken 2, Grosvenor Place, close to Hyde Park Corner. London, W., on a long lease at a rental approaching £10,000 a year, for use as offices. The building, which was formerly the town mansion of the Duke of Buccleuch, has recently been occupied as the Caledonia Club for Scottish Servicemen.

Five hundred gallons of methylated spirit were destroyed on Wednesday last week, when fire broke out in the Blackfriars Street premises of Anderson, Gibb & Wilson, wholesale drysalters, Edinburgh. But for the prompt arrival of the local Fire Forces. who prevented the outbreak from spreading to adjoining buildings, the damage might have been considerably greater.

An amendment slip, No. PD.474, has recently been issued to the British Standard for white spirit, B.S.245. The slip announces the deletion of the requirement limiting the residue after spontaneous evaporation and describes an alternative method for the determination of volatility. Copies of the slip can be obtained free from the B.S.I., 28 Victoria Street, London, W.1.

Speaking at the annual meeting of Boots Pure Drug Co., Ltd., recently, Lord Trent stated that the company had followed up its pioneer work in developing the production of penicillin by making a comprehensive study of the new therapeutic agent known as streptomycin, an agent that held out promise of being of value in the treatment of some human diseases that did not respond to penicillin. The company was well advanced in its investigations.

The Ministry of Food has now indicated its readiness to import 800 tons of sardine oil held at Lisbon by a Fife importer and originally destined for the linoleum industry. They stipulate that the price should be reasonable and they reserve the right of allocation, although indicating that the linoleum industry will receive most of the oil. The possibility that herring and other fish oils may be used as a substitute for linseed oil in paint and allied products is now being explored.

Damage to the extent of thousands of pounds was recently prevented by the prompt action of Sir Shanti Bhatnagar, who is in this country as leader of a delegation of Indian scientists. Walking in Oxford, he noticed flames coming from the Organic Chemistry Laboratory. He tried to enter the laboratory and give the alarm, but found the door locked, so he climbed to a window, forced it open, climbed in and extinguished the fire, saving the building and its valuable contents.

The announcement made last Saturday by Scottish Oils, Ltd., of the closing of Hopetoun and Deans oil works at the Breich shale pit, West Lothian, will affect some 500 shale miners and oil workers. The miners should be able to get work in neighbouring pits, but there will be considerable unemployment among the oil workers. By concentrating operations at fewer oil works, it is hoped to increase their production more nearly to the full capacity, with a corresponding reduction in costs.

In his speech at the annual general meeting of Newton, Chambers & Co., Ltd., the chairman, Sir Samuel Roberts, Bt., announced that for some years they had been experimenting with a resin lacquer used for coating the linings of brewery tanks, food containers, etc. This lacquer prevents corrosion and is acid-resisting. They found it to be popular and profitable, so they had formed a new branch with its own manager to develop it with energy. The chairman also expressed his confidence in the successful future of the chemicals branch.

A special certification mark applicable to plastic materials and products has been registered by the British Standards Institution. The scheme covering the use of the mark is administered by the Mark Committee of the B.S.I. in collaboration with the British Plastics Federation. Details are obtainable from the B.S.I., 28, Victoria Street, London, S.W.1.

Over 100 acres at Airdrie, in the Glasgow area, have been bought by Boots Pure Drug Co., Ltd., for the purpose of erecting a new factory. In making this announcement, the chairman, Lord Trent, said that owing to dispersal schemes and the introduction of new industries into Nottingham, the company had found difficulty in getting female labour. He hoped there would be no labour shortage in Scotland.

I.C.I. announce that their southern region sales office has moved from Mill Hill to Gloucester House, 149 Park Lane, London, W.1 (tel.: GROsvenor 4020), to which all correspondence should now be addressed. Until further notice, the telephone number Mill Hill 3600 should still be used for calls to the following departments: agricultural, dyestuffs, engineering trades, household products, metals, distribution, accounts and packages.

Foreign News

The annual shipment of 250,000 tons of thorium-bearing sand from India to America has been discontinued, and the production of thorium in India will in future be permitted only in the closest arrangement with the Government, according to *Science and Culture.*

A Danish-American syndicate is boring in Jutland in a search for rock salt and oil. According to local press reports, the syndicate has discovered rich deposits of rock salt at a depth of 750 ft., sufficient, it is claimed, to cover the demands of the whole of Scandinavia for 1000 years.

The potash industry of Alsace, according to latest information from France, has now attained a production level equal to the pre-war standard, at least so far as extraction from the mines is concerned. Output of concentrated salts has reached 85 per cent. of the 1938 level.

From India comes news that the Atomic Research Committee of the Council of Scientific and Industrial Research, at its first meeting in Bombay recently, expressed the opinion that atomic research should be given first priority and encouraged by the Government of India on a very large scale. The committee recommended that a betatron, capable of 2,000,000-volt rays, be established at the Tata Institute, with a team of ten scientists for its operation.

New Companies Registered

Neo-Chemicals, Ltd. (414,987).—Private company. Capital, £100 in £1 shares. Manufacturers of and dealers in chemicals, etc. Director: E. V. Cherubini. Registered office: 36 Oxford Street, W.1.

Sam Kyle, Ltd. (24,304).—Private company. Capital, £3000 in £1 shares. Dealers in all kinds of chemicals, minerals, etc. Director: Samuel Kyle. Registered office: 6 Auchanfoshan Terrace, Glasgow.

A. B. Knight (London) Ltd. (415,181.)—Private company. Capital £1,000 in £1 shares. Importers or exporters of chemicals of every kind. Director: R. Epstein. Registered office: 203 Regent Street, W.1.

Ambrol Products, Ltd. (413,534).—Private company. Capital £100 in £1 shares. Chemical manufacturers, etc. Directors: J. Fletcher, J. C. Kenny. Registered office: 30 Willow Street, Accrington.

Stevens & Hodgson, Ltd. (414,156).—Private company. Capital, £10,000 in £1 shares. Manufacturers of and dealers in plant and appliances for use in the chemical trades, mining and quarrying, etc. Subscribers: W. R. Stevens; J. R. Hodgson. Registered office: 38 Gt. Charles Street, Birmingham, 3.

Company News

Permission to deal in £19,245 ordinary stock has been granted **I.C.I., Ltd.**

British Industrial Plastics, Ltd., have been granted permission to deal in 1,500,000 new ordinary shares of 2s. each.

It is announced that the name of **D.D.T. Products, Ltd.,** 41 North John Street, Liverpool, has been changed to **D.D.T. Insect Products, Ltd.**

Minimax, Ltd., is paying a final dividend of 8 per cent., making 16 per cent. for the year, plus bonus of 4 per cent. (both unchanged). Net profit for 1945 is returned at £38,457, in comparison with £38,502 for 1944.

Eno Proprietaries, Ltd., report net profits of £151,403 for the year to March 31 last, the figure for the previous year being £160,027. Ordinary dividend totalled £122,625 (£124,917).

The net profits of **Macleans, Ltd.,** for the year to March 31 last are given as £268,842, in comparison with £177,827 for the previous year. The ordinary dividend is 45 per cent.

The report of **Yeast-Vite, Ltd.,** for the year to March 31 last gives net profits as £163,532, as against £171,986 for the previous year. Ordinary dividend is 15s. 10d. per share.

Veno Drug Co., Ltd., made net profit of £244,696 for the year to March 31 last, as against £217,105 for the previous year. Dividend on deferred ordinary shares is 2s. per share.

Net profits of **Beecham Maclean Holdings, Ltd.,** for the year to March 31 last, are reported as £361,562, compared with £263,773 for the previous year. The ordinary dividend is 46 per cent.

Net profit of £56,482, in comparison with £47,908 for the previous year, is reported by **A. Boakes, Roberts & Co., Ltd.,** for the year ended March 31 last. A final ordinary dividend of 2 per cent. added to interim dividends totalling 9 per cent. makes 11 per cent. for the year, an increase of 2 per cent.

Provision for £8000 expenditure on research during the current year is made in the accounts of the **Yorkshire Dyeware and Chemical Co., Ltd.** Including dividends from and profits of subsidiary companies, the net profit is given as £45,577 for the year to March 31 last, as compared with £40,344 for the previous year. The final dividend of 12½ per cent. makes 17½ per cent. for the year, as against 10 per cent. dividend and 5 per cent. bonus for 1945.

The **Beecham Group** report for the year to March 31 last shows trading profit, etc., of the company and subsidiary companies totalling £2,756,106, as compared with £2,474,987 for the previous year. Net profits of the group were £437,528 (£367,902). Dividend on the 10 per cent. preferred shares amounted to £100,000 (same); on 5 per cent. redeemable preference shares to £7500 (same); and three interim dividends on the deferred shares, aggregating 32 per cent., plus 4 per cent. victory bonus, totalled £288,131, as against £242,000.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

SATINITE, LTD., Widnes, chemical manufacturers. (M., 27/7/46.) June 20, charge, to Westminster Bank, Ltd., securing all moneys due or to become due to the Bank; charged on 41 Tunnet Road, Wallasey; 30 Osmaston Road, Prenton; and 9 Milnthorpe Street, Garston, Liverpool. *Nil. December 3, 1945.

PLASTICRAFT, LTD., Kingsbury, manufacturers of plastics. (M., 27/7/46.) June 25, £2000 debentures; general charge. *£4300 debentures. September 22, 1945.

OMEGA PLASTICS, LTD., London, E.C. (M., 27/7/46.) June 20, mortgage and charge, to Midland Bank, Ltd., securing all moneys due or to become due to the Bank: charged on 79 Washington Avenue, Little Ilford, together with machinery, utensils, etc., also a general charge.

SCOTT BADER & CO., LTD., Wollaston, celluloid merchants, etc. (M., 27/7/46.) June 27, mortgage, to Midland Bank, Ltd., securing all moneys due or to become due to the Bank; charged on Wollaston Hall, Wollaston, 17 Broadway, and 121 Midland Road, Wellingborough, and 2 Westfield Avenue, Higham Ferrers, with machinery, etc., also general charge. *Nil. March 1, 1946.

Satisfaction

SIR WILLIAM BURNETT & CO. (CHEMICALS) LTD., Isleworth. (M.S., 27/7/46.) Satisfaction June 27, of charge registered March 15, 1934.

Chemical and Allied Stocks and Shares

HELPED by a better trend in "Kaffirs," the recent reaction in which was an unsettling influence, stock markets have shown a satisfactory undertone, although British Funds reflected home political uncertainties and were somewhat less firm. Argentine rails relapsed following their recent advance, and home rails were dull pending the interim dividend decisions. Despite the attention centred on new issues, buying interest predominated in the industrial section, but on balance movements have been small and indefinite.

Imperial Chemical eased to 42s. 9d., Turner & Newall were 92s. 6d., Levers 56s., and Metal Box shares at 118s. 9d. xd were firm on the chairman's statement that, when regulations permit of a bonus, it is the intention to bring the issued capital more into line with that actually employed in the business. Despite the good results, General Electric eased to 103s. 9d. xd on the possibility that part of the company's business may be nationalised. Associated British Engineering jumped 15s. to 61s. 3d. on the directors' proposals, but in contrast, Brush Electrical 5s. ordinary eased on the latter to 11s., De La Rue were firm at £12¾, with British Industrial Plastics 2s. ordinary 8s., and Kleemann 45s. Dealings in British Xylonite ranged up to close on £8, while Ilford strengthened to 80s. Greeff-Chemicals 5s. ordinary transferred at slightly over 13s., Monsanto Chemicals 5½ per cent. preference marked 23s. 9d. and, elsewhere.

Metal Traders shares were good at 27s. 3d. Fisons were dealt in up to 63s. 4½d., and Cooper McDougall up to 43s. 6d., W. J. Bush at 90s., and Burt Boulton at 27s. 6d. B. Laporte were maintained at 100s., with business up to 102s. 6d. Morgan Crucible first preference have changed hands at 29s.

Iron, coal and steel shares showed small irregular movements, although Lambert Bros. were good at 80s., and a further rise to 16s. 3d. in Pease & Partners was attributed to estimates as to the break-up value of the shares. Stewarts & Lloyds eased to 49s. 6d., and Tube Investments to £6 1/16, while Ruston & Hornsby moved lower at 57s. 6d. Guest Keen were 37s. with the new shares 2s. 3d. premium. In other directions, Dunlop Rubber were 73s. 9d.; the new debentures were 3¼ premium over the issue price of 101. Among Indian securities, Indian Iron were prominent with an advance to 103s. 9d. Textiles eased, although on hopes of improved results, Calico Printers strengthened to 23s. 9d. British Celanese were 36s. 9d., and Courtaulds 56s. 6d.

Borax Consolidated kept steady at 49s British Aluminium improved to 43s. 3d. on the growing demand for the metal, but British Plaster Board eased to 35s. 6d., and Associated Cement to 70s. Still reflecting the good results, British Glues 4s. ordinary were 15s. 10½d. with the participating shares higher at 45s. 6d. General Refractories have receded to 22s. 4½d., but in other directions, Triplex Glass rallied to 41s. 3d. after an earlier decline, although there are conflicting views in the market whether a higher dividend is likely for the past financial year.

Boots Drug rose to 65s. on the meeting, but later eased to 64s. 9d., while Beechams deferred have been 27s. 3d. on the full results. Sangers held firm at 33s. 9d., and Timothy Whites rose further to 48s. 6d. The units of the Distillers after further rise, receded to 134. United Molasses were 56s. 6d., and Imperial Smelting 19s. 6d.; but Amalgamated Metal came back to 21s. 3d. British Tar Products shares changed hands up to 14s. 6d., and British Lead Mills around 12s. International Bitumen Emulsions shares have transferred up to 7s. 4½d. Oil shares showed small movements, Shell easing to 94s. 4½d. after 95s. Anglo-Iranian strengthened to 100s. 7½d. on the full results and the news that the company's production reached a record level last year.

British Chemical Prices

Market Reports

AN active demand continues in almost all sections of the London industrial chemicals market and the effect of the approaching holiday season has been hardly noticeable. Supply problems remain the chief feature and although there has been a slight improvement in one or two directions there is no immediate prospect of an easing in the allocation arrangements which are in operation for a number of products. A considerable export demand for pigments is awaiting an improvement in raw material supplies, and the position is the same for zinc oxide, titanium oxide, lithopone, sulphate of alumina, and chromium sulphate, to mention but a few of the items concerned. The undertone of the market is very firm and the trend of prices is towards higher levels. A strong tone characterises the market in coal-tar products and available supplies are already booked. Rather more inquiries for cresylic acid are reported.

MANCHESTER.—In spite of the seasonal holiday influences, which are leaving their mark both on deliveries to the consuming end and on the volume of new business, fairly steady trading conditions have been reported on the Manchester chemical market during the past week. Textile and other industrial chemicals are being taken on the home market in reasonably good quantities and export inquiries during the past week have covered a wide range of both light and heavy products. The undertone is very firm in all sections. Fertilisers are seasonally quiet, but in the tar products a steady demand continues and with one or two exceptions the make is finding a ready outlet.

GLASGOW.—Considerable activity was experienced in the Scottish heavy chemical market last week on the resumption after the holidays. Prices generally show a continued tendency to increase and supplies are not readily available. The export market has been exceedingly busy with inquiries and orders for formaldehyde, aluminium and zinc stearates, toluol, xylol, carbon tetrachloride, copper sulphate, and sulphur: The supply position for export is not improving owing to the return of export restrictions on certain commodities, including zinc oxides, and certain difficulties are also being experienced with shipment.

Price Changes

Lead Nitrate.—About £55 per ton d/d in casks.

Lithopone.—30%, £28 2s. 6d. per ton.

"Nitro Chalk."—£9 16s. per ton in 6-ton lots, d/d farmer's nearest station.

Oxalic Acid.—£100 to £101 per ton in ton lots, packed in free 5-cwt. casks.

Sodium Sulphide.—Solid, 60/62%, spot, £20 2s. 6d. per ton d/d in drums; crystals 30/32%, £13 7s. 6d. per ton d/d in casks.

Sulphur.—Per ton for 4 tons or more, ground, £14 15s. to £16 10s., according to fineness.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Vapour generating devices.—Steam Torch Corporation. 17670.

Liquid-supply systems.—Sterling Industries, Ltd., and P. E. Thomas. 17770.

Acid pickling tanks.—N. Swindin. 17445.

Water cooling towers.—J. E. Temple. 17342.

Vitamin D composition.—W. W. Triggs. (E.I. Du Pont de Nemours & Co.) 17892.

Welding devices.—B. H. L. Williams. 17706.

Hydrazo esters.—Wingfoot Corporation. 18111.

Heat-resisting alloys.—Allegheny Ludlum Steel Corporation. 18861.

Heat exchangers.—Aluminium Plant & Vessel Co., Ltd., and H. F. Goodman. 18414.

Aluminium base alloys.—Aluminium Co. of America. 18862.

Moulding powders.—A.S.P. Chemical Co., Ltd., C. L. Walsh, B. A. Adams, and H. R. Bott. 18892, 18893, 18894.

Barium carbonate.—F. W. Berk & Co., Ltd. (F. W. Berk & Co., Inc.). 18907.

Barium sulphates.—F. W. Berk & Co., Ltd. (F. W. Berk & Co., Inc.). 18908.

Lithium recovery.—F. W. Berk & Co., Ltd. (F. W. Berk & Co., Inc.). 18909.

Alkali earth metals.—F. W. Berk & Co., Ltd. (F. W. Berk & Co., Inc.). 18910.

Treatment of cellulose pulp.—Bertrams, Ltd., and A. G. Stewart. 18826.

Treatment of ores.—Bolidens Gruvaktiebolag. 18604.

Welding equipment.—E. A. Bost. 18389.

Organo-silicon compounds.—A. Bowman, E. M. Evans, J. R. Myles, L. C. Payman, and I.C.I., Ltd. 18876.

Dyestuffs.—British Celanese, Ltd. 18307.

Dyestuffs.—British Celanese, Ltd. 18459.

Hydrocarbons.—British Thomson-Houston Co., Ltd. 18882.

Coating compositions.—British Thomson-Houston Co., Ltd. 18883.

Inorganic compounds.—Cinema-Television, Ltd., and R. B. Head. 18283.

Chemical recovery devices.—D. Dalin. 18592.

Treatment of gases.—L. J. Derham, and F. J. Johnson. 18887.

Insecticides.—K. B. Edwards. 18213.

Organo-siloxanes. — J. G. Fife (Dow Chemical Co.). 18628.

Heat exchangers.—M. Frenkel. 18619.

Magnesium coating.—H. M. F. Freud. 18691.

Light aluminium hydroxide. A. B. Futo. 18631.

Processing of iron ore.—General Electric Co., Ltd., and P. Rabone. 18429.

Emulsifying, etc., equipment.—F. W. G. Greener. 18447.

Ferro-chrome.—W. B. Hamilton. 18520.

Hard alloys.—Hard Metal Tools, Ltd., and E. M. Trent. 18743.

Mica sheets.—M. D. Heyman. 18610.

Treatment of fatty acids.—Lever Bros. & Unilever, Ltd. 18577.

Welding.—Linde Air Products Co. 18354-5.

Analysis of gases.—J. Malecki. 18746.

Treatment of aqueous solutions.—E. N Mason & Sons, Ltd., and F. A. Soward. 18579.

Heat determination of liquids.—W. M. Mercer. 18612.

Complete Specifications Open to Public Inspection

Vinyl ethers and polymers thereof.—General Aniline & Film Corp. Dec. 28, 1944. 31840/45.

Polymerisation and interpolymerisation of ethylene. — Imperial Chemical Industries, Ltd. March 14, 1942. 12006/43.

Dispersion of ethylene polymers.—Imperial Chemical Industries, Ltd. Aug. 10, 1942. 12893/43.

Dialkyl peroxides as polymerisation catalysts.—Imperial Chemical Industries, Ltd. Nov. 16, 1942. 18987/43.

Granular calcium nitrate with a low water content. — Lonza Elektrizitätswerke und Chemische Fabriken A.G. Dec. 19, 1944. 30238/45.

Morpholine salts of sulphonated azo dye components and their preparations.—Marconi's Wireless Telegraph Co., Ltd. Dec. 21, 1944. 34639/45.

Preparing a material which has a high content of carotin.—N.V. Philips Gloeilampenfabrieken. Oct. 17, 1941. 14024/46.

Producing water-insoluble layers on substrata, and the manufacture of preparations suitable therefor.—N.V. W. A. Scholten's Chemische Fabrieken. Aug. 18, 1944. 14070/46.

Catalytic treatment of sulphur - bearing hydrocarbon distillates.—Shell Development Co. Dec. 21, 1944. 28781/45.

Unsaturated halogenated hydrocarbons.—Shell Development Co. Dec. 19, 1944. 28782/45.

Basic calcium chlorate from solutions containing both calcium chlorate and chloride.—Solvay & Cie. Dec. 20, 1944. 33678/45.

Catalytic conversion system.—Standard Oil Development Co. July 3, 1941. 78293/42.

Catalytic synthesis of hydrocarbons.—Standard Oil Development Co. Dec. 20, 1944. 15746/45.

Continuous crystallisation in vacuo of sugar solutions and the like.—G. L. Willaime. Sept. 30, 1941. 13728/46.

Amino acids.—Winthrop Chemical Co., Inc. Dec. 19, 1944. 26142/45.

Alkyl aminocyanoacetates. — Winthrop Chemical Co., Inc. Dec. 19, 1944. 26667/45.

Complete Specifications Accepted

Synthetic resinous reaction products of aldehydes and triazine derivatives.—British Thomson-Houston Co., Ltd. July 29, 1942. 578,196.

Resinous condensation products. — W. Charlton, J. B. Harrison, and I.C.I., Ltd. Feb. 2, 1944. (Samples furnished.) 578,229.

Manufacture of metal castings by the centrifugal method.—Clay Cross Co., Ltd., and F. Jervis. Dec. 13, 1940. 578,296.

Polymerised product and method of making same.—F. J. Cleveland (Pittsburgh Plate Glass Co.). Jan. 19, 1942. 578,266-7.

Production of soaps and like hydrolysis and neutralisation products.—Colgate-Palmolive-Peet Co. July 11, 1942. 578,278.

Copper alloys.—M. Cook, W. O. Alexander, and I.C.I., Ltd. Jan. 14, 1942. 578,223.

Treatment of gases or vapours with liquids.—O. G. Dixon, and I.C.I., Ltd. June 16, 1943. 578,309.

Production of halogenated hydrocarbons.—E. I. Du Pont de Nemours & Co. Oct. 4, 1944. 578,179.

Manufacture of rubber-like plastic materials.—E. I. Du Pont de Nemours & Co., and J. L. Parker. June 21, 1944. 578,214.

Refractory compositions.—C. E. Every (Titanium Alloy Manufacturing Co.). Aug. 16, 1944. 578,177.

Production of gas-expanded ebonite.—Expanded Rubber Co., Ltd., and A. Cooper. March 14, 1944. 578,233.

Manufacture of nickel-iron alloys.—General Electric Co., Ltd., and R. C. Chirnside. July 16, 1942. (Cognate applications 9906/42 and 10737/42.) 578,193.

Insecticidal coating compositions.—I.C.I., Ltd., A. C. Hetherington, and E. G. Noble. March 31, 1944. 578,206.

Refractory lining for melting pots used in the alumino-thermic extraction of metals.—E. Lux. April 15, 1944. 578,165.

Stabilisation of 1, 2-dinitroethane.—C. W. Scaife, and I.C.I., Ltd. May 19, 1944. 578,169.

Production of cellulose ethers.—J. H. Sharphouse, and J. Dawning. Nov. 22, 1943. 578,286.

Machines for the extraction of oil or other liquid from seeds, meal and the like.—A. W. Sizer. Feb. 10, 1944. (Cognate applications 2447/44 and 3901/44.) 578,202.

Process for the manufacture of amides and of azo dyestuffs obtainable therefrom.—Soc. of Chemical Industry in Basle. Feb. 6, 1941. (Cognate applications 1583/42 and 1584/42.) 578,268.

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VOL. LV No. 1414. — August 3, 1946 — Annual Subscription 21s. Overseas 26s.

Isaac Newton

THE tercentenary of Newton's birth should have been celebrated in 1942, a year during which we were occupied by more pressing events. The wise decision was then taken by the Royal Society to defer the official celebrations of this event until the danger which menaced freedom of thought throughout the world had been removed. Now that we have rolled down our sleeves and put our coats on again, we have been able to turn our minds to the victories of peace—victories no less renowned and more enduring than those of war.

It is well that this generation should appreciate the debt that it owes to Isaac Newton. It is too commonly believed that because the science of those days was sparse, because scientific knowledge was rudimentary, the stature of the older scientists was lower than those of their modern descendants. A distinction must be drawn between the extent of knowledge and the discovery of new knowledge. The student of 1946 has far more to learn than his counterpart of the 17th century. There were comparatively few books, but Latin and Greek were required of the educated man. Education was concentrated on the humanities. Scientific knowledge was embryonic and for the most part incorrect. The mass of known facts is to-day so great that no student of science can learn more than the basic facts and the principles of his science; at an early age he must specialise, so that he gets little chance of a wide education such as was given to the youth of past generations. The pressure upon students is greater to-day than ever it was. Is that one reason for a different outlook on research and discovery? The mind must become saturated with existing knowledge before it sets out on voyages of discovery. Science has become a professional employment, whereas once it was the plaything of the amateur; and it is not in science alone that this change has come to pass.

The discovery of new knowledge is to be sharply distinguished from the acquisition of existing knowledge. Discovery demands special qualities of mind; courage to strike out boldly into new territory, acute perception to deduce new principles from known facts, clear thinking, and above all deep and continuous thought. Great as were the achievements of Newton, he recognised the existence of much that he had not discovered. He speaks, in those oft-quoted words, of "the great ocean of truth lying all undiscovered before me." It is difficult to discover the truth in

On Other Pages

an untrodden field. It is doubly and trebly difficult to discover truth when everyone else is convinced of the " truth " of beliefs that are in fact erroneous.

There is perhaps no single anecdote about Newton which has so seized the popular imagination as that concerning his discovery of the force of gravity—an immense achievement, if one comes to think of it, sufficient of itself to make his name known for evermore. We were taught as children that, sitting beneath an apple tree, the fall of an apple to the ground caused him to wonder why it fell downwards and why it did not float upwards. If it had befallen in that naïve manner, the discovery of gravity would have been unique in the history of science. Many historians have roundly denied the story of the apple, but there is evidence from Newton's own times that there was truth in it. Dr. Stukeley dined with Newton at Orbels Buildings, Kensington, on April 15, 1726, a year before his death at the age of 85, and wrote in his diary: " After dinner, the weather being warm, we went into the garden and drank thea *(sic)*, under the shade of some apple trees, only he and myself. Amidst other discourse, he told me, he was just in the same situation, as when formerly, the notion of gravitation came into his mind. It was occasioned by the fall of an apple, as he sat in a contemplative mood. . . ."

It was justly said by another great scientist much later in time than Newton that "Chance only favours the prepared mind" (Pasteur). That is a principle which all research workers must follow. Intense thought on an intractable problem may appear to yield no solution till one day a trifing incident shows the truth like a lightning flash. What deep thinker has not experienced this? Thus, the probability is that Professor Andrade's account of the discovery of gravitation is the correct one. Newton, aged about 23, was staying at Woolsthorpe and thinking hard about the moon's motion. Why does it not fly away as a stone does when whirling round on a string and the string is released? What is the equivalent of the string which keeps the stone on its appointed circular path so long as it is firmly attached to hand and stone? The fall of the apple suggested the train of thought that the same pull of the earth that pulls the apple to the ground might extend to the moon.

The story of the apple, while it has a lesson for all who would follow in Newton's footsteps, has unfortunately obscured much of the light that Newton shed on his contemporaries and down through the ages to us. He is undoubtedly the greatest figure in science. He is the supreme mathematician of all time; the inventor of the calculus; the author of the *Principia*, in which he calculated not only the effect of the conception of gravity on the motions of the planets, but also the main irregularities of the moon's motion caused by the gravitational pull of the sun and of the earth, as well as explaining the tides. The general foundations of mathematical science are laid in the *Principia*, including early conceptions on wave motion. The magnitude of these achievements can be best understood when it is realised that, before his work, the accepted idea was that the motions of the heavenly bodies were due to special celestial causes generally of an occult nature. This of course was the basis of astrology. Newton had been born into a world which ascribed occult causes to even the simplest of happenings, which still was ridden by witchcraft. There were scientific workers in the modern sense before him, of course, and it has been truly said that Newton himself stood upon the shoulders of giants. Nevertheless, it was he who showed to the world the modern scientific methods, he studied Nature's ways, from the facts thus gleaned he deduced general laws from particular cases, and he showed finally how by those " laws " great classes of happenings could be explained.

It was not only in mathematics and in the motions of heavenly bodies that Newton's work was so prolific of results. His book on optics has been known and studied for generations and has laid the foundation for a great deal of subsequent work.

A remarkable fact about Newton was that the *Principia* was finished by the time he was 40 years of age and after that date, although he made certain additions and corrections to the *Principia*, he did not publish much more original scientific work of outstanding importance. He was for many years President of the Royal Society and it cannot be doubted that that Society, and consequently the evolution of science in Great Britain, owes a great deal to his administrative genius. Newton in fact was no freak genius but the concentrated embodiment of all the distinguishing characteristics of British scientists. Starting as an investigator and original thinker, he finished, as do so many scientists, as an

administrator. At this delayed tercentenary it is well to remind ourselves of the impact of Newton's life on the lives of everyone engaged in following the scientific method. He was the supreme genius and while, no doubt, ordinary people cannot follow " a mind for ever voyaging through strange seas of thought alone," all can at least seek to follow the scientific method which he initiated.

NOTES AND COMMENTS

Keeping Up Appearances

IT is probably a good thing to maintain an impressive façade when things are not going too well, but there is undoubtedly a limit to the value of " keeping up appearances," a practice which has sorely strained the resources of many commercial and domestic organisations in the past, and will probably continue to do so in the future. Nationally speaking, we are doing quite a lot of this sort of thing at the moment. Figures, such as those illustrating our export trade, are presented in the most optimistic manner, and the forthcoming " Britain Can Make It " exhibition is an excellent example of the practice of patting oneself on the back. Everybody concerned would probably feel happier, if the title of the show were " Britain *Will* Make It." All this philosophising arises from the perusal of a letter to the *Birmingham Post* from Mr. L. C. Hill, joint managing director of the County Chemical Company, in which he considers with disfavour the prospect of holding a British Industries Fair at Castle Bromwich early next year.

Are We Ready for the B.I.F.?

MR. HILL makes the two following points : (1) Even with an increased supply of raw materials, export orders on hand will take more than two years to complete; and (2) Owing to restrictions, we are not yet in a position to pack our products in containers of post-war design. Moreover, as he cogently points out, where are we going to lodge our overseas visitors to the Fair, and how are we going to feed them? Visitors who remember the catering arrangements at Castle Bromwich from pre-war days will not be expecting anything very handsome in the way of entertainment, it is true, but it is dubious whether even this standard will be attained in 1947. Mr. Hill goes so far as to express the hope that prospective exhibitors, old and new alike, will refrain from taking space at Castle Bromwich in 1947, but will reserve their energies for the following year. Certainly, in a display like the British Industries Fair, our industrialists will be committing themselves to deliver the goods in a way that is not implied in an exhibition like this year's coming affair at South Kensington.

Lignite Wax " On the Air "

QUITE by a coincidence we had arranged to publish Clement and Robertson's paper on the utilisation of Scottish peat in the very week in which appeared the Fuel Research Station's booklet entitled *The Extraction of Ester Waxes from British Lignite Peat*, by Dr. C. M. Cawley and Dr. J. G. King (H.M.S.O., 6d.). The B.B.C. authorities regarded this pamphlet as of sufficient importance to award it a place in the 8 o'clock news last Monday, and although the work of Cawley and King has already been discussed in THE CHEMICAL AGE (1945, *53*, 384; *see* also 1943, *49*, 539), it is convenient to have the findings of the D.S.I.R. investigators compactly bound in one small volume. The whole thing is the result of having to find a war-time substitute for montan wax—the hard ester wax extracted by solvents from lignite—of which, before the war, Germany was practically the exclusive supplier. The only really important deposit of lignite in Britain is at Bovey Tracey, Devon, and the investigators found that the wax from this lignite was satisfactory as a substitute for montan wax—about 5 per cent. of the lignite being recovered as wax by extraction with benzene.

Wax from British Peat

THESE investigations open up the possibility of developing a new British industry—small it may be, but none the less important—by encouraging the production of this wax for peace-time uses. The amount of lignite available is restricted, but our supplies of peat, as the paper pub-

lished later on in this issue shows, are considerable. The Fuel Research Station workers found that from 2.7 to 11.8 per cent. of the dry substance of peat could be recovered as wax; but that this showed certain differences from the lignite wax, and, in particular, had a lower melting-point, though the valuable dielectric properties were similar. It was found that the wax content of peat depended on the nature of the vegetation from which it had been derived: peats derived from cotton-grass, heather, and *Scirpus* are relatively rich in wax. Of the 20 samples examined, nine were from English sources, eleven from Scottish. The English samples tended to uniformity, whereas both the best and the worst results came from Scotland, the outstanding example being from "a fairly normal stretch of hill peat" in Banffshire. The official report does not go further than to say cautiously that "it is possible that the utilisation of peat waxes for industrial purposes is worth further investigation." Considering the comparative ease of winning peat, it would certainly appear well worth while, especially in view of the opportunity offered of developing a suitable industry in "special" areas.

Canadian Copper

TOWARDS the end of the war, fears were being expressed in Canada about the possibility of marketing that Dominion's copper production, which had greatly expanded during the war years, as it was pointed out that the war-time contracts from the United Kingdom would soon be automatically terminated. As it proved, these fears were groundless, especially as the U.S. relieved the difficult transitory situation by taking Canada's surplus copper for the remainder of 1945 after the war had ended. Now the trouble lies the other way. With the gradual recovery of industry, the demand for copper exceeds the capacity of smelters, and a world shortage has developed. This is aggravated by the fact that Canadian producers, having for six years pushed on with war production at all costs, were unable to carry out programmes of development with an eye to the future. Moreover there has been a sharp drop in production from the copper-nickel deposits of Ontario, owing to the greatly decreased demand for nickel in peace time. In 1946, so far from restricting its copper purchases to Africa, the U.K. received some 33,000 tons of copper from Canada in the first half of the year, and has asked for a much greater tonnage for the second half. The remainder of Canada's surplus will go, through UNRRA, to the war-torn lands of Western Europe.

Post-War Markets

IT will be some years before conditions can approach the normal again. The devastated European countries not only require quantities of non-ferrous metals to re-establish their industries, but also find themselves unable to meet these demands from their own resources, their mines, smelters, and refineries having been looted and smashed during the period of occupation. In addition, protracted strikes in the U.S. copper industry have added to the problem, and the Civilian Production Administration in the U.S. has appealed to producers to ration supplies. Canada, too, has not been without its strikes. In a review of the Canadian copper trade before the war, the *Commercial Intelligence Journal* points out that 67 per cent. of the total value of Canadian copper exports was in the form of primary metal, mostly to the U.K. and other European countries; concentrates and matte accounted for 15 per cent., mainly to the U.S., Japan, Norway, and the Netherlands; 12 per cent. was in the form of rods, strips, etc. again mostly to the U.K.—about 5 per cent. was in the form of blister copper (all to the U.S.); and about 1 per cent. as insulated cable and wire—an interesting feature being the sudden rise, in 1939, in U.K. imports of this type of material. It now appears as though the traditional European markets for Canadian copper were likely to resume their old importance with the signal exception, of course, of Germany.

German Technical Reports

Particulars of Latest Publications

SOME of the latest technical reports from the Intelligence Committees in Germany are detailed below. Copies are obtainable from H.M. Stationery Office at the prices stated.

BIOS 523. *Carl Alexander Mine, Baesweiler, near Alsdorf*: The de-ashing of coal by froth flotation and acid extraction and the Ruhrwerks coal cleaning process (2s.).

BIOS 545. *Seifenfabrik Rose, Frankfurt Osthafen*: Soap substitutes (6d.).

BIOS 547. *Nalle and Co., A.G., Wiesbaden-Biebrich*: "Tylose" cellulose derivatives (2s.).

BIOS 569. *Glass or enamelled lined equipment on steel and iron for chemical food and allied industries* (2s.).

Peat

An Undeveloped Raw Material of Scotland

by

A. G. CLEMENT, B.Sc., A.R.I.C., and ROBERT H. S. ROBERTSON, M.A., F.G.S.

OF all the little-worked resources of Scotland peat is the most important, for it covers about one-tenth of the entire area of the country, may well exceed 1,000,000,000 tons (dry weight), and has many interesting varieties and potential uses.

In the table below is shown the estimated amount of peat which several countries possess and the amount of peat is also expressed in relation to the area and population of each country.

Country	*Peat area (sq. miles)*	*Population (million)*	*Acres per head of population*
Finland	38,000	3.8	6.4
Canada	37,000	10.4	2.28
Sweden	19,200	6.5	1.90
Eire	4,700	3.0	1.0
Norway	2,900	3.0	0.62
Scotland	3,100	4.8	0.415
Russia	65,000	184.1	0.225
Austria	1,500	6.7	0.143
England and Wales ...	6,300	41.0	0.098
Germany	9,900	65.3	0.097
Denmark	400	3.7	0.069
U.S.A.	11,200	135.6	0.053

It is clear then that the finding of profitable uses for peat concerns Canadians, Scandinavians, Irish, and Scots much more deeply than, say, the Americans or English. We find then that in Eire, Norway, and Sweden substantial Government funds have been devoted to the investigation of peat. In Scotland, however, we are not fortunate in having any research and development organisation which could develop industries using peat as a raw material.

Peat Winning

The uses to which peat can be put may be classified as those which require it in an air-dry form and those which do not (see diagram). The production of air-dried peat economically is the chief difficulty in the utilisation of peat; cutting and drying peat is not easy. Peat in the bog has about 19 parts of water to one part of solid, and the best draining will reduce this only to 11 or 12 parts to one. For fuel and many other purposes the ratio must not exceed 1 part of water to 3 parts of solid.

Hand-cutting is a costly and laborious method, but it is the only method known for dealing with certain types of light brown peat which contain a high proportion of fibre. The bulk of the peat cut in this country to-day is hand-cut. However, mechanical methods, which work very well, have been evolved for cutting black peat. Many such machines are at work in Germany, Sweden, Denmark, and Russia, and they work on the bucket dredger principle, delivering the peat into a hopper, from which it is extruded in briquettes ready for spreading in rows on the ground and air-drying. It is now some forty years since these machines were first developed, and none are in use in this country. With a crew of three, they do the work of about 100 hand-cutters.

Within the last decade a new method of cutting and drying peat has been evolved and put into use in Eire, Sweden, and Denmark. This involves milling a layer about ½-in. deep on the surface of the bog; the finely disintegrated peat thus produced dries in a matter of a day or two and is then collected, and a fresh lot milled. This method is more subject to weather conditions than the cutting in blocks, but it represents a definite advance in technique. There is believed to be a similar process for the production of milled peat in Russia.

As an efficient drier will not remove more than about 4 parts of water per part of dry peat burnt as fuel, some very cheap method of getting rid of 12 parts of water must be devised. Exposure to sun and wind is the cheapest known, and practically all peat-drying is therefore climatic. However, machines have been made which squeeze the water out of peat. These generally have a pair of heavy rollers or bands between which the peat passes. Colloidal types of peat cannot be treated by such machines, but the suggestion has been made that it might be possible to dewater these peats by endosmotic methods, and there are Russian claims to have reduced the water content to 25 per cent. by this means.

There seems a very good case, since such progress has been made in foreign countries, for carrying out an extensive research programme on these problems in this country. The high cost of making and testing machines makes it impossible for any one peat firm to finance such a programme. Most of the peat firms in this country do not have research facilities and their policy of marketing only one product and that, peat moss litter, a low-priced commodity, makes them financially unbalanced and incapable of sustained research. Hence it seems obligatory on the Government to take the initiative in developing our peat resources by initiating research along the lines indicated.

Peat has received Government recognition only spasmodically. On occasions, such as famines in Ireland, commissions were set up to see if they would recommend the development of the peat bogs as a means of enabling the Irish to earn enough to buy food. In

the 1914 war shortage of fuel brought peat to the fore again, and the D.S.I.R. carried out some very valuable work, published in 1921-2, on the fundamentals of air-drying, and the extent of Irish peat resources. With the secession of Eire in 1921 the work stopped. Again, in the latest crisis, the possibility of using peat was revived, but the only official steps taken were to recommend it to be used in army camps in peat districts whenever possible. This policy, or lack of it, must be changed if our peat deposits are to become anything other than an unused national asset and a source of employment to a mere handful of men.

Peat as Fuel

Since peat has only about half the calorific value of coal, it is obvious that the greatest possible mechanical and thermal economy must be exercised in utilising it. This means that handling must be reduced to a minimum, and the conclusions of a number of workers in this line are that works making use of peat as a fuel must be situated on or near the peat moss. This is the case with power stations in Germany and Russia which are fuelled with peat, and the gasification of peat at Hamburg proved uneconomic only because of the long railway haul from East Friesland.

Very high thermal efficiency is a matter of design, and the Russians, who are the largest users of peat, have devoted considerable attention to this. It is estimated that their peat-fired power stations have a capacity of 1,000,000 kW., and the quantities of peat used as fuel in U.S.S.R. and Germany are as under:

	Year	Tons	Per cent. of total fuel produced
Germany ...	1928	700,000	0.4
U.S.S.R. ...	1913	1,675,000	1.7
U.S.S.R. ...	1927-28	5,310,000	4.3
U.S.S.R. ...	1940	20,000,000	–

Three types of furnace have been developed for burning peat: the Makarev chain grate, which makes use of lump peat only; the Shirshnev, in which milled peat is fed into the furnace; and the Ivanov system, in which peat in a finely powdered form is injected into the furnace with an air blast. Combustion is instantaneous and the furnace runs at such a high temperature that the ash is run off as a slag. The hot gases emerging from the furnace are used to dry the incoming peat and the heat passing through the furnace walls heats the air blast. A water-tube boiler is used, and with the low sulphur content of peat the tubes last many times as long as in a coal-fired furnace.

Distillation and Gasification

Large-scale distillation of peat was carried out by the Lewis Chemical Co., which was founded by Sir James Matheson in 1859. Dr. Paul, the engineer and chemist, was not very competent and for the first two years the gas was let out into the atmosphere, poisoning much of the surrounding vegetation. Later its calorific value was discovered and it was made use of. Peat gas has a peculiarly unpleasant odour. The Lewis works produced considerable amounts of charcoal and tar, but after running at a loss for a number of years—due, it is said, to mismanagement, and not to the commercial impracticability of the process—it closed down in 1874.

During the 1914 war the Government took over the firm of Wet Carbonising, Ltd., at Dumfries, and produced at great cost a quantity of peat coke briquettes, which it was intended to use in the trenches. The process was not successful and was closed down. The Fuel Research Station carried out some valuable work on the distillation of peat in 1922 and published their results, which showed that given peat at a suitable price (just over half the price of coal), distillation was quite a feasible proposition. The test, mentioned above, on gasification at Hamburg gasworks in 1938, confirmed these results, and one firm at Oldenburg carried on distillation of peat for over twenty years. The products are peat charcoal, used in gas generators, tar used for impregnating fire lighters, and peat gas.

Agriculture

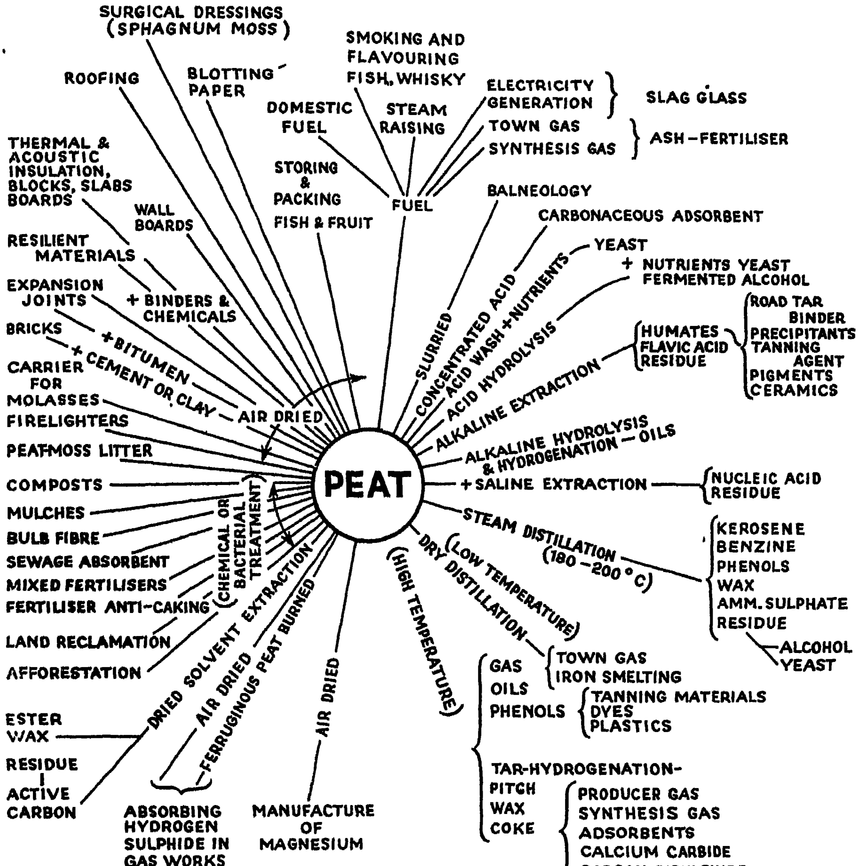
Although peat moss litter and granulated peat are important in horticulture and agriculture, there is room for the development of mixed fertilisers, treated peats, and sewage absorbents. Sphagnum peat is already being used as an absorbent for molasses, but can also be used as a substance for growing yeast fodder.

Where commercial utilisation of peat is unlikely, afforestation is often possible, and even after removing the peat the land can often be turned into agricultural land. If all the peat lands of Scotland were effectively drained there would be a noticeable increase in the average temperature of the atmosphere, and local improvements in climate would almost certainly be felt.

Building Materials and Other Uses

Light brown peat can be converted into thermal insulation for houses, factories, refrigerators, ships, and trains. It is very like cork-board in its properties. Hard boards can also be made. A Scottish chemist has made an internal brick from peat and cement. Other products are resilient materials, acoustic insulation, expansion joints, and roofing felts.

Peat is used in Scottish gas works for increasing the efficiency of iron oxide in desulphurising town gas. Ferruginous peats, known in Scotland, could be used in place of imported or synthetic oxide. During the



The Field of Peat Utilisation

war large quantities of light peat were used in the manufacture of magnesium.

Among the most interesting uses of peat are those which require little or no preliminary drying. Of these, one which should be tried in Britain is the late Professor Ernst Berl's process of converting carbohydrates to oils by alkaline hydrolysis and hydrogenation under pressure.

In Eire ester wax is extracted with solvents, and some British peats have been analysed for wax. The use of the residue presents a difficulty here.

Research and Development

A survey of peat is already being undertaken by the Geological Survey, with the collaboration of the Macaulay Institute for Soil Research, and the first publication is the Survey's War-Time Pamphlet No. 36. It will be clear that industrial development is not likely to arise from this work unless the geological and botanical surveying is accompanied by certain physical and chemical measurements which will be of interest to those contemplating using peat for certain specific purposes. Firms or individuals interested in the many uses of peat could be called together at intervals with members of the Research Station staff to discuss what tests would be of value, and the surveyors could send, from each deposit visited, samples to the Station for testing. As many as twenty or thirty standard tests may have to be done on each sample, but many of these tests would be mechanised and would not take long to carry out in a central laboratory.

Little progress can be made unless all the available knowledge about peat is collected together, so that research workers may have the benefit of knowing previous work. The scientific literature on peat is scattered in journals all over the world, and though much of the early work is quite valueless, a constantly maintained review of the literature

on peat would give a valuable body of information which would be useful in planning future research and development.

Scientific and technical information about peat would need to be filed by some effective and modern method of documentation. We have advocated in a previous bulletin* a modified Holmstrom method of arranging and filing facts, and we have found that this method is a research tool, not a sterile collection of facts. Gaps in knowledge become apparent and suggest new lines of attack in research. Summaries of knowledge can be quickly compiled from a Holmstrom "index" and these may be used in their turn to supply industry with the facts required for the industrial development of processes. To be useful, then, documentation must be accompanied by a qualified and positive information service.

In Bulletin No. 8 we showed the stages in development of a process, survey, analysis laboratory investigation, pilot plant development, and full-scale working. To these we should add a sixth stage, regional development—the integration of the proposed industry with the life and work of the region where it is to be set up. It is important to recognise the need for continuity of development through these six stages, and to have machinery for maintaining this continuity. The machinery we have suggested is a Raw Materials Research Station in Scotland or a Scottish Research Organisation. having the power to carry out work at any stage of development where existing organisation are unable to do the work for reasons other than lack of money, and to co-ordinate the work in the whole programme of development.

Extraction, distillation, drying, milling, and other processes would be investigated in the laboratory, and promising processes carried forward to the pilot-plant stage. Fundamental facts about the physics of these processes would enable full-scale plant to be designed. Research would also be directed towards finding applications for the products.

Finally, not only would cost accountants determine the profitability of the processes but economists would ascertain the best locations for the new industries and would see how they could dovetail in with already established or other possible industries in the areas selected. Robert Maclaurin has already suggested in Bulletin No. 9† how peat carbonisation could be fitted in with a gas grid. For the North of Scotland special attention would be given to processes dependent upon electrical energy, and the use of peat as insulation for Highland houses or in peat-cement bricks.

Conclusions and Recommendations

Scotland has large resources of peat, only very special varieties of which are commercially utilised. The experience of peat industries abroad and the present state of knowledge acquired by unco-ordinated effort would justify an amply financed research and development plan to be carried out mainly in Scotland where this raw material is relatively abundant.

* Scottish Reconstruction Committee Bulletin No. 7.

† Published by the Scottish Reconstruction Committee, 213 West Campbell Street, Glasgow, C.2.

Copper Works Fatality

Sequel to Bursting of Tank

THE bursting of a settling tank at McKechnie Brothers' copper works, Widnes, as a result of which an employee received fatal burns, was described at an inquest at Widnes recently, on William Ernest Melvin, aged 33.

Evidence given was to the effect that Melvin told a foreman that one of the liquor tanks was leaking. The tanks contained about 1350 cu. ft. of liquor, and were heated between 82-88° C. The foreman went into the shed and started to pump to take the liquor out of the settling tanks. By that time the liquor was all over the floor, and he was ankle deep in it. The pump was working at full pressure. Planks used to cover the pipes and sump were washed away. One of Melvin's fellow-workers saw him pull his left leg out of the sump. He took off Melvin's wellington boot, and carried him out of the shed into the ambulance room and left him in the care of the ambulance men. Melvin died later of shock, following burns of the left leg.

It was stated that since the accident heavier copper plates had been placed over the sump. A verdict of "Death by misadventure" was recorded.

The Moscow Steel Institute is reported to have developed a method for the manufacture of coloured steel, based on the addition of certain elements during the alloying process.

Demand for cobalt has, according to the chairman of the Union Minière, greatly increased during the war, the main applications being for special steel, alloys, and magnets. An alloy containing more than 70 per cent. of cobalt is at present being tested for compressors of diesel locomotives and this has already given remarkable results in efficiency and fuel consumption. Great hopes are also entertained for the application of cobalt alloys in lining the combustion chambers of motor engines requiring a metal capable of standing corrosion at high temperature, as well as for marine engines.

The 200-Inch Telescope

Chemical and Engineering Problems in its Construction

by R. L. WATERFIELD

THE great adventure of building the 200-inch telescope is nearing completion. It all started out of an article by the late Dr. George Hale, director of the Mount Wilson Observatory, California, in *Harper's Magazine* in 1928. Within a few weeks a gift of $6,000,000 had been promised and within a few more Hale had started the ball rolling. Experiments in making a quartz mirror were started in 1929, and ended in failure in 1931 after the expenditure of $600,000. The astronomers then switched over to Pyrex and by the autumn of 1935 the 200-inch mirror had been successfully cast and annealed. The grinding and figuring of the mirror had to be suspended when America entered the war in 1941; but by then the building and mounting for the instrument was well-nigh complete. Work on the figuring of the mirror was resumed this year and during the last few weeks has gone ahead so successfully that it is now confidently expected that the completed telescope will be ready to go into action by the autumn of next year.

Astronomical telescopes are of two sorts. In the refractor the image is formed by the main lens, or object glass; while in the reflector the same function is performed by a mirror with a parabolically curved reflecting surface. In both cases the image is examined with an eyepiece which is really a low-power microscope. In a refractor the lens is at the top end of the telescope as in an ordinary spy-glass. In a reflector the mirror is at the bottom of the tube which is thus open to the sky: the light from the star under examination is reflected back up the tube and deflected by a small flat mirror, set at 45 degrees, into the eye-piece which is thus fixed in the side of the tube near its upper end. Though the eyepiece can be changed to produce whatever magnification is required, the upper limit to the magnification is determined by the diameter of the object glass or mirror.

Effect of Atmosphere

Unfortunately, another limit is set by the earth's atmosphere. Theoretically, the 100-in. telescope now at Mount Wilson could magnify 10,000 diameters, but our atmosphere is seldom if ever steady enough to employ a magnification of over 1000 diameters with advantage. But the size of the mirror or object glass determines something more important than magnification: it determines the *light-grasp* of the telescope. Every time the diameter is doubled we can see or photograph objects just four times as faint: we can in fact penetrate just twice as far into the universe.

An object-glass consists of two lenses set close together, and the light is refracted four times as it enters or leaves the four surfaces of the composite lens. Both discs of glass must be of the highest optical perfection, and each of the four surfaces must be figured to the correct curvatures to within a few millionths of an inch. A mirror consists of a single glass disc of which only the front surface has to be accurately figured. To ensure the perfect figure of this surface the glass disc must be of high optical quality throughout; but since the light is reflected, without penetrating the glass, from a thin silver film deposited on the *front* surface, the glass need not have the exquisite optical perfection required in a lens. Thus the difficulties in producing the glass and the labour involved in figuring are enormously less in the case of a mirror.

Size of Refractor Limited

To ensure rigidity the thickness of a lens or mirror must increase in proportion to its diameter. With a lens a point will ultimately be reached when the gain due to the increased light-gathering power of the surface is counteracted by the loss due to light absorption in passage through the glass. Again, when a lens reaches a certain size it will begin to bend appreciably under its own weight, for it can obviously be supported only round its edge. Neither of these limitations applies to a mirror; for the light does not penetrate the glass, and the weight of the disc can be taken by supports evenly distributed over its back surface. The largest refractor in the world, the 40-inch erected at the Yerkes Observatory, Chicago, in 1897--also due to the efforts of Hale—already approaches this upper limit. So the construction of appreciably larger refractors is not practicable.

Reflectors have one disadvantage: their figure is extremely sensitive to changes in temperature. During the greater part of the night the temperature is usually falling rapidly; but until the temperature of the mirror is approximately the same throughout its substance, the image will be distorted and the focus will be continually changing. This cannot be prevented by thermostatic control since the mirror has to be of the same temperature as that of the outside air. A lens, on the other hand, is practically unaffected by changing temperature;

so, for accurate measurement and most routine work, a refractor is preferable.

Until recent years astronomy was mainly concerned with the measurement of the positions of the heavenly bodies, and for this purpose great light-grasp was not important. On the other hand for most of the problems of the newer science of astrophysics, which deals with the structure of the universe and the nature of its component bodies, light-grasp is the essential requirement. Hale long ago realised this and was mainly responsible for the erection in 1908, at the newly-founded observatory on Mount Wilson, of the first of the great modern reflectors with a 60-inch mirror. The achievements of this instrument in the direct and spectroscopic photography of objects far beyond the range of lesser instruments so impressed astronomers, and Hale in particular, that he was soon pressing for a still larger aperture; and by 1918 he had erected at the same observatory the 100-inch telescope. Since then several other large reflectors, ranging from 60 to 80 in. in diameter, have been built, chiefly in America, Canada, and South Africa.

Overcoming Difficulties

The enormous step from 100 to 200 inches now contemplated involved great difficulties and uncertainties. The 100-inch mirror weighed over 3 tons; a similar 200-inch mirror would weigh 40 tons. The mechanical problem of mounting such a mirror to follow the stars with perfect smoothness and rigidity would be terrific. The 100-inch disc had taken a year to anneal, a 200-inch disc would require about eight years in the annealing oven; even then the mirror would probably be unusable, for there would never be time, even during the longest nights, for the temperature of its entire mass to reach equality with that of the night air. There seemed to be three possible ways of getting round these difficulties. First, to make the mirror of stainless steel, the high heat conductivity of which would ensure its rapid cooling. Secondly, to make the mirror of quartz, of which the coefficient of expansion is only one-twelfth that of glass. Or finally, to compromise between quartz and glass by using a special Pyrex with a coefficient of expansion of one-quarter that of glass. The great weight of a steel mirror decided against its adoption; but it is possible that in the future a light metal alloy may be found with the necessary high reflecting capacity.

It was therefore decided to try quartz: to cast a 200-inch disc of rough quartz and afterwards spray its surface with a thin layer of pure quartz. This was necessary because fused quartz is highly viscous and it is impossible to get rid of the large numbers of bubbles which become trapped within its substance. It was found that by spraying the surface of the rough disc with a rain of fine droplets of quartz a uniform thin layer of clear quartz could be produced which was capable of being satisfactorily figured and polished. Satisfactory mirrors up to 2 feet in diameter were made in this way, but the difficulties increased rapidly with the size, and all attempts to produce a 5-foot mirror ended in failure. It was realised that, although the 200-inch mirror might ultimately have been achieved, its expense would have been so great that there would have been no money left for the rest of the telescope. So in 1931 the astronomers switched over to Pyrex, a special Pyrex with an unusually low coefficient of expansion.

Weight of Disc Reduced

It was decided to cast the Pyrex in the form of a disc with a ribbed or honeycombed back and a comparatively thin continuous front surface. In this way the weight of the disc would be reduced from the 40 tons it would have had if it had been solid to about 14½ tons. Moreover, not only would there be a much smaller mass of glass to cool, but the honeycombed back would greatly increase the area of the cooling surface. It was hoped that the performance of such a mirror might at least approximate to that of the ideal quartz mirror.

The production of the disc was entrusted to the Corning Glass Works. They made in succession an experimental 26-inch solid disc and a series of ribbed discs 30, 60, and 120 inches in diameter, which were to form the various subsidiary mirrors for the completed telescope. It was soon found that the special Pyrex to be used, with its higher melting point, was much more difficult to pour than the ordinary plate glass. The high quality fire-brick used in the moulds for ordinary glass mirrors was quite useless. At the higher temperature the moisture imprisoned in the bricks was liberated, filling the Pyrex mass with numerous bubbles. It was found necessary to build the mould of pure white silica bricks which had been made from a mixture of ground-up cork, sand, and water, and fired in a kiln until the cork was burned out and the moisture expelled. The result was a brick which contained no moisture and was extremely porous. Thus no bubbles were liberated, and any that were carried in during the pouring process could escape through the pores.

Again, the usual method of allowing the molten glass to flow down a trough from the melting oven into the mould had to be abandoned, for the Pyrex rapidly chilled and the trough got blocked. Instead they had to revert to the ancient method of ladling by hand. In the mould first tried for casting the 30-inch ribbed mirror the cores projecting from its base to produce the honeycomb structure were held in place by a special furnace cement. But the cement

was unable to withstand the heat, and the cores broke loose and floated to the surface of the molten mass. A second attempt was made with a mould in which the cores were anchored down by dowels fashioned out of the same silica brick, and a perfect result was obtained. It was noticed, however, that owing to the rapid chilling of the Pyrex it had not filled the mould quite evenly at the base of the cores. Though the defect in the present disc was too small to matter, it was clear that it would undoubtedly assume serious proportions in any attempt at a larger disc. So for the 60-inch disc they built a special casting oven to keep the mould hot during the process of ladling. At the first attempt the cores again came adrift. A second attempt was made after taking special precautions with the fitting of the dowels; but still one of the cores broke loose and floated to the surface. It was fished out and, after annealing, the missing hole was drilled out from the back. Despite this accident polarisation tests showed the disc to be optically satisfactory.

Before starting on the 120-inch disc the problem of the cores was again attacked. This time it was decided to make them hollow and build them up round steel bolts with large heads which would anchor them to the base. To save expense the casting and the annealing ovens were built large enough to house the 200-inch disc when required. In order to assist the ladling process the ladles were suspended from monorails running from the melting to the casting oven, though they still had to be controlled by hand. The casting of the 120-inch disc succeeded at the first attempt, and a perfect disc was removed from the annealing oven.

A Set-back

The casting of the 200-inch disc was planned for Sunday, March 25, 1934, and a preacher in Pennsylvania loudly forecast its failure. Towards the end of the ladling, when all appeared to be going well, several of the cores broke loose and floated to the surface. With great difficulty they were broken up into fragments; the ladling was then continued and completed ten hours after the start. It was decided to make another attempt, but meanwhile the present damaged mirror could be used to test the time required for annealing. It was therefore annealed at ten times the rate which calculation suggested ought to be perfectly safe, and was removed after only one month in the annealing oven. Polarisation tests showed that the strains which had developed in the glass were still well within the limits set by the astronomers. The core debris was then drilled out of the front surface and the disc reheated until its surface had melted smooth and then annealed again. It would at least serve as a spare mirror for the telescope.

The next and final attempt was made the following December. This time the cores were anchored down with bolts of chrome nickel, and each core was fitted with an internal air-ventilating system to keep it cool. This time the casting went off without a hitch. The mould for the great disc was supported on a circular steel table heated by electric coils; and this in its turn was carried on a heavy truck running on a wide-gauge railway track from beneath the casting oven to beneath the annealing oven. The table could be jacked up so as to fit into position beneath one or other of the two ovens. After the casting, the disc in its mould was transferred to the annealing oven, where it was kept at a constant temperature for two months and then cooled uniformly for a further eight months. All went well until three months before the end of the period, when the Chemung river, near by, flooded its banks and rose higher than it had done for 17 years. Despite every effort to stay the advance of the water, the electrical plant controlling the oven was partially flooded, and for three days the current had to be switched off. Fortunately, when the oven was finally opened and the decisive tests performed, the disc was found to be perfect.

Transporting the Disc

For the journey from the eastern seaboard to California the disc in its casing, weighing in all 35 tons, had to be carried in a vertical position in a truck constructed specially for the purpose. Though the well-truck carrying the mirror cleared the ground by only a few inches, the top of the casing stood 17 ft. 7 in. above the rails and the clearance of at least three bridges on the route was only 17 ft. 10 in. At Kansas City a last-minute detour had to be made: frost had raised the rails and the bridge clearance was insufficient. Again through the tunnel at Johnson Canyon, Arizona, the train had to travel through on the east-going line to ensure safe clearance. During the two weeks journey across the continent, only travelling in the daytime and never exceeding 25 miles per hour, the train took precedence over all other traffic. It was preceded by a scout train and accompanied by an armed guard, who during night-time halts at country sidings allowed nobody within 500 yards.

The grinding and figuring of the disc has been done at the optical shops of Mount Wilson in Pasadena. By the time America entered the war the rough grinding was over and the figuring was progressing rapidly. When work was resumed early this year there remained to be levelled a peripheral zone and a central hillock of a few thousandths of an inch. That has now been accomplished, and the final figuring to within a few millionths of an inch is well

under way. The method is very slow and must proceed by trial and error: after a brief period of polishing, hours must elapse for the temperature of the glass to settle down and permit the tests to be done. Though it is impossible to say how long it will take to achieve the required perfection, everything indicates that the mirror will be ready in about a year's time.

The telescope tube is about 60 ft. long and 22 ft. in diameter. Complete with the mirror at one end and the small chamber suspended in the middle of the mouth of the tube to carry the observer, the whole telescope tube weighs 125 tons. The yoke in which the telescope swings to point to any part of the sky weighs about 300 tons; of this, 170 tons is accounted for by the huge horseshoe bearing at the upper end of the yoke which is no less than 46 ft. in diameter—the biggest bearing ever made. Thus the total weight of the moving parts of the telescope is about 425 tons. The steel structures supporting the upper and lower bearings of the yoke add a further 75 tons, making about 500 tons for the weight of the whole instrument. The revolving dome of the building which houses the telescope is 137 ft. high and 135 ft. in diameter. It stands on Mount Palomar, about 125 miles from Pasadena and about 100 from Mount Wilson, at an altitude of 5600 feet.

It would now seem that all the problems have been solved and that no further serious difficulties can arise. But one doubt still remains: how will the telescope perform? Will the low coefficient of expansion of the special Pyrex and the ribbed structure of the disc suffice to overcome the tendency to distortion of figure due to the ever-varying night temperature? Certain astronomers still keep their fingers crossed.

Silicophosphate

Experiments in East Africa

THIRTY tons of silicophosphate have been made by the East African Industrial Research Board for supplying agricultural authorities with material for field trials and it is hoped that by the end of the 1945 season a considerable volume of evidence will be available on its yield effect on annual crops.

This is recorded in the recently-published annual report of the Board. An account is given of extensive surveys carried out by Departments of the Government of Uganda leading to the opening of a rock-phosphate mine near Tororo, which produced supplies of several thousand tons of a slow-acting fertiliser—a factor, incidentally, which contributed to the spectacular war-time expansion of the Kenya wheat crop.

The Research Board undertook the development of a process for converting the raw rock into a more available form of fertiliser which could replace superphosphates. The soda-calcination process developed in the Research Board's Laboratory, partly on the basis of a German process of the 1914-18 war, now offers the prospect of converting the Uganda phosphate into fertiliser of perhaps even greater suitability for East African soils than superphosphates.

The name silicophosphate was recently adopted in the U.K. for a phosphatic fertiliser made by the calcination of a mineral phosphate with silica and soda ash. Although the process for soda-calcination treatment of the Uganda rock phosphate developed by the Board differs in some ways from the British process, the final product is from a practical point of view closely similar.

A Unique Deposit

The special character of silicophosphate rests on the fact that its contained phosphoric oxide is largely insoluble in water, but soluble in dilute acids. In accordance with modern agronomic thought, phosphoric oxide in this form is likely to be readily taken up by plant roots. It is probable that no mineral phosphate deposit exactly similar to that at Tororo is exploited elsewhere in the world unless the Kola deposits of North Russia may be regarded as similar.

The Kenya Agricultural Department carried out a limited number of field trials on small grains in 1945. All indicated a considerable increase from silicophosphate over the controls and some increase over the other forms of phosphatic fertilisers.

LETTER TO THE EDITOR

Inert Spindle-Oil

SIR,—I was very pleased to see an excellent review of our booklet on the above subject in your issue of July 27. There is one point which I would like to bring to your notice, *i.e.*, in the third paragraph of the column I see that you state that our non-carcinogenic white oils have "improved lubrication properties showing a drop in 'bolster' temperature of up to 70° F. over old-type oils."

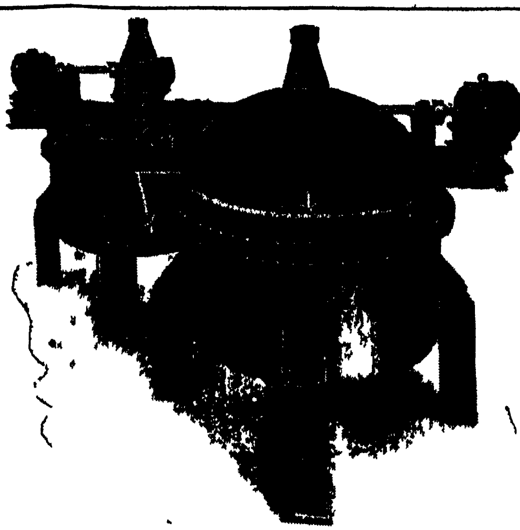
The figure 70° F. is obviously a printer's error, as in our publication we stated that the drop in "bolster" temperature was up to 7° F. I thought I had better bring this to your notice, as although it is only a minor printing error, it is of some importance, as we never like to make exaggerated claims for our products.—Yours faithfully,

for Manchester Oil Refinery, Ltd.
D. Brook Hart.

London, E.C.4.
July 29, 1946.

Metallurgical Section

Published the first Saturday in the month



Metallurgical Section

August 3, 1946

Forming of Aluminium Alloys

Use of the Rubber Die Press

A COMPARATIVELY new process that should be of particular interest because of its possibilities to the post-war user in simplifying many problems in the production of aluminium and aluminium alloy components is described in A.D.A. Information Bulletin No. 11, "Forming of Aluminium Alloys by the Rubber Die Process."*

Since its introduction to industry in 1935, the use of the rubber die press has developed rapidly. The Ministry of Aircraft Production quickly recognised the possibilities of the process, and at once designed and put into production a series of presses capable of meeting the requirements of the aircraft industry speedily and economically.

The process will aid manufacturers who need to produce quickly components varying in size and shape, but are not required in quantities that warrant the use of hardened steel tools and dies. The rubber die process is normally carried out with simple and relatively inexpensive tools, which can be produced without elaborate tool-room plant and craftsmen.

An introduction in the bulletin explains that the rubber press consists essentially of a thick rubber pad housed in a steel container strong enough to withstand the maximum pressure exerted on the press platen. The thickness of the rubber is about two-thirds the depth of the container. Dies made from harwood, zinc or steel are placed on the surface of the platen, the sheet material to be formed being positioned on the dies by suitable location pegs. As hydraulic pressure is applied, the movement of the platen forces the dies and the sheet material against the rubber pad, which, when deformed, compels the metal to shear, bend or form to the shape of the die.

Until recently it was generally accepted that the use of rubber in conjunction with press tools was dependent on the ability of the rubber to flow, *i.e.*, that when pressure was applied to a quantity of rubber placed in a closed vessel or container a resultant reaction was set up on every surface with which the rubber came into contact. At the same time, it was noted that, in contrast with a purely fluid medium like water, rubber possesses the property of cohesion, or resistance to "free flow." Now, however, it is believed that the fluid-like flow of rubber is almost inappreciable and that it is the frictional properties of rubber that are decisively important in forming components by the rubber die press. In other words, the ability of the rubber under pressure to react to and form sheet metal parts is due to the resistance of the rubber to deformation.

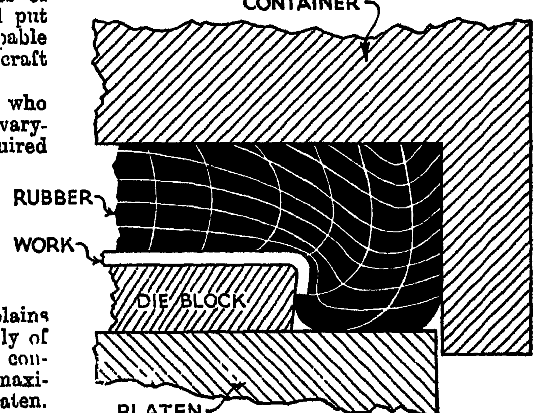


Fig. 1.

Action of rubber pad under compression.

The pressure obtainable is limited by the shear strength of the rubber, once the rubber begins to shear, the pressure concentration falls so rapidly that completion of the operation is impossible. The frictional properties of the rubber also have considerable influence on the working action of the rubber pad since the process is a dry one, achieved by a combination of stretching and displacement. Very little slip takes place, and what does is over vertical surfaces, never over horizontal, as may be shown by placing spots of wet paint upon the metal to be deformed; it will be found that they are transferred to the face of the rubber pad without appreciable smearing. The face of the rubber clings by friction to the metal blank at the point at which it first touches the blank and remains at that spot even when full pressure is obtained, the

* Published by the Aluminium Development Association, 67 Brook Street, London, W.1.

more distant parts of the rubber pad being displaced and stretched over the work and the dies on which it is being formed. This action of the rubber is shown in Fig. 1.

Although most modern rubber die presses have been designed for use with high pressures, a considerable amount of work on sheet of from 14 to 20 s.w.g. is produced on presses with which low pressures are used. These presses require a slightly more complicated die design than those employing high pressures, but for many applications the saving in power may make them more economical.

Good pressings may be produced on small presses with as little as 150 tons capacity, but most normal hydraulic presses of this type use between 300 to 600 tons pressure, with a platen pressure of 0.7 tons/sq. in. reinforced by mechanical means. An ironing plate made of ½ in. boiler plate, cut away in the centre so that it just clears the finished shape of the component, is located on top of the blank material. When the pressure is applied the rubber comes into contact with the surface of the plate and is forced into the space cut out of it. The rubber thus compressed forces the material to the shape of the die. The ironing plate itself greatly helps in preventing the formation of wrinkles at the corners of the part. Unless large parts of heavy gauge are required, these low-pressure types of press with moderately soft rubber will form all standard parts of normal size. Working on a single large ram, they have a very rapid cycle, particularly when designed to accommodate four loading tables.

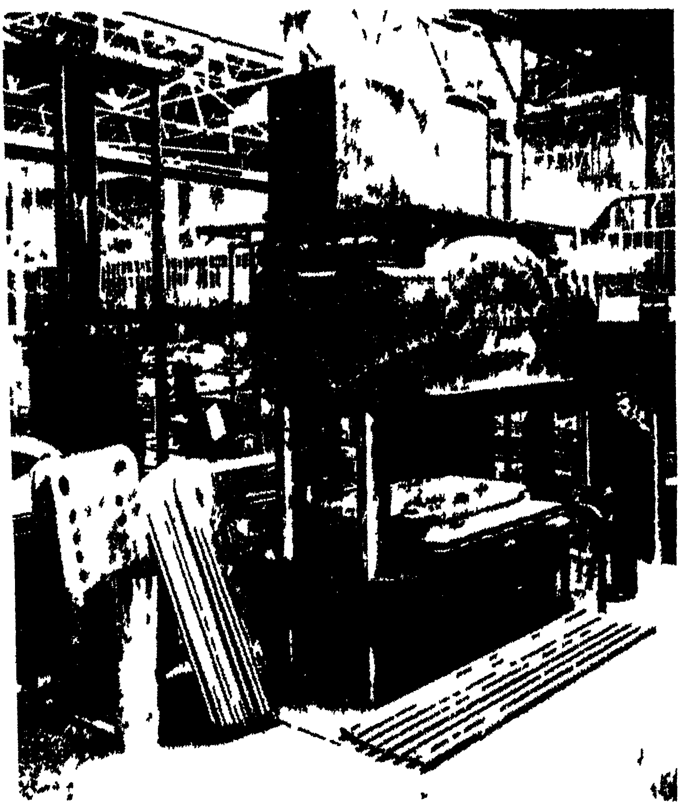


Fig. 2. Small 500-ton rubber press after the forming stroke

The rubber pads used on these low pressure presses are either solid or built up from 1 in. laminations of 50 to 55 Shore hardness. The internal pressure of this soft rubber is not always adequate to complete all forming operations, in which case it is

Two types of press, standardised by the Ministry of Aircraft Production during the war, are in general use in this country, one a high power type of cast steel unit construction, the other a low power type of mild steel plate construction. In the high-

power type units each of about 2670 tons rating, with a platen area of 3 ft. by 4 ft., are coupled together to form presses rated at 5340, 8000 and 10,700 tons respectively, with a maximum pressure of 1½ tons/sq. in., working dimensions being respectively 6 ft. by 4 ft., 9 ft. by 4 ft., and 12 ft. by 4 ft. The low-power type is built in sizes ranging from presses of 500 tons capacity with platen dimensions of 3 ft. by 2 ft. (such as that illustrated in Fig. 2), to machines of 2600 tons capacity with platen dimensions of 6 ft. by 4 ft., the pressure in all cases being 0.5 tons/sq. in.

In a description of the method of using the rubber die press, the bulletin states that the rubber pad is housed in a steel container strong enough to withstand the total bursting pressure exerted by the platen, the thickness of the rubber being about two-thirds the depth of the container. The dies are grouped upon the surface of the platen and the blanks placed upon them, located with pins. The dies and blanks are brought into contact with the rubber pad and pressure applied. The steel container prevents lateral movement of the rubber, thus forcing it against the blanks and dies. Due to its elasticity the rubber deforms as pressure increases, forcing the metal blanks to assume the shape of the dies. On removing the pressure, the rubber goes back to its original form ready for the next operation.

If separate blanks are used for each component they are placed in position by location pins on the dies. Provided that dies of approximately the same height are grouped together, the gauge of metal need not be the same for all the components. When a single sheet is being formed into blanks, the dies should be grouped economically and the sheet placed over them. Pressure is applied to all blanks simultaneously so that they are formed with one stroke of the ram. When blanks for large numbers of components are to be sheared, the shearing dies should be grouped over the loading table so that they occupy the entire area of a sheet of stock size. The sheet is then placed over the dies and pressure applied.

Technique of Press Work

Dies and tools are described in detail and a considerable portion of the booklet is devoted to the technique of rubber die press work. The methods detailed are: blanking and piercing (together with the essential press requirements); flanging in its various forms, with graphs showing the respective concave and convex flanges that are permissible without wrinkling or splitting; how moderate drawing operations can be achieved with the aid of supplementary rubber pads; and means of overcoming spring-back in heat-treated alloys, together with useful tables of springback angles for simple straight flanges.

Shortage of Metals

Need for Empire Survey

REFERENCE to the shortage of some metals in the British Empire was made during the Empire Scientific Conference in London, in a discussion on the need for a co-ordinated survey of the mineral resources of the Empire.

It was pointed out that the situation with regard to lead, for instance, is serious, and its price is about four times what it was a few years ago. Even more grave than a temporary shortage is the fact that within 20 years the Empire's proved lead resources will not be able to meet the demand at the present rate of consumption and the same is true of zinc. It is probable that intensive geological work would reveal the presence of hitherto unknown deposits and thus amply repay the cost. In addition, active research is necessary to enable processes for the treatment of what are now regarded as unworkable deposits to be developed for the recovery of their useful contents.

Speakers from the Dominions and Colonies made it clear that geological staffs are at present totally inadequate. In some parts of Australia, for example, there is only one State geologist to 100,000 sq. miles, while some of the Colonies have not a single Government geologist, so that over large parts of the Empire the mineral resources are unknown. This contrasts very strongly with what happens with some mining companies; in Northern Rhodesia, for example, private companies employ about 80 geologists. They proved the existence of one of the largest copper fields of the world, and at that time there was not a single Government geologist in Northern Rhodesia. There is at present a great shortage of trained geologists and it would take at least five years to make up this shortage even under the most advantageous circumstances.

In former days mineral deposits were discovered on the surface by the old time prospector, but henceforward it will be the concealed deposits missed by the untrained prospector which will contribute to the Empire's prosperity. These can only be discovered by scientific and systematic investigations based on the geological map.

It was resolved that the need for a co-ordinated survey was of paramount importance and detailed recommendations are now being prepared.

The Orure smelting plants in Bolivia, where experiments have been carried out during the last decade with low-grade tin ores, are now for the first time producing pig tin of 99.5 per cent. at less than $60 per ton initial smelting costs, which will be reduced as operations progress.

The Protection of Stainless Steel

Retention of Surface Polish

IN polishing stainless steels to a finish, extreme care is exercised at the mill to obtain a flawless surface free from pits, scratches, and similar defects. For certain applications of polished sheets, no fabrication is necessary. In such cases, only careful handling is required to preserve the lustrous finish. Many applications of polished sheets, however, such as restaurant, hospital, and kitchen equipment, dairy and meat packing equipment, and many architectural uses, require brake or press work, followed by welding or soldering, and the necessary grinding and polishing at welds. It is essential in these instances that precautions be taken to eliminate the possibility of scratches, dents, and other marks on the polished surface.

It is difficult to match by hand, on a formed object, the finish that was obtained on polishing machines at the mill. Hence, it is to the advantage of the fabricator to protect the polished surface before any work is begun rather than to be faced with the job of polishing out marks that may have appeared through improper protection in forming. While it is not maintained that it is possible to prevent scratching and rubbing entirely on all types of work, the fabricator will save trouble, time, and money by exercising every precaution against damage to a polished surface.

The Adhesive Tape Method

Several methods of lubrication are being used, from among which the fabricator should select the method best adapted to his particular operations. The first consideration should be given to the condition of the dies. They should be well polished and at the first sign of any pick-up of the metal the press brake should be stopped and the dies stoned and polished.

A satisfactory method for preserving polished finish is the application of adhesive tape to the dies. This method can be used where the work applied to the metal is not severe, such as in bends on hand brakes. Its use is not recommended for deep drawing. The merit of this type of protection is that it prevents direct contact between the polished surface of the sheet and the hardened steel of the dies. Similarly, the use of thin paper between the polished metal and the die is working well in some cases. Wax paper, oiled paper, cellophane, and in some cases even ordinary newspaper have been used with marked success in the elimination of die scratches. The paper is used as an adjunct to the lubricant.

Another method of protecting the surface of polished sheets both in shipping and handling is to apply ordinary wall-paper with wheat paste—allowing about 12 hours to dry. Also adhesive paper and tape up to 36 in. in width are obtainable from several sources. If soldering or welding is necessary after the sections have been formed into various shapes, the protective paper may be removed with hot water where the parts are to be joined. The protective paper may either be removed before shipping the parts, or on the other hand the surfaces may be permitted to remain covered, especially in building construction, until ready for the final cleaning. The proper time for removal is governed, therefore, entirely by the application.

Dealing with "Building Filth"

The use of polished stainless steel for exterior decorative purposes in building construction has made necessary the means of protecting it from what may be termed "building filth," i.e., plaster, cement, concrete, ashes, rust from steel work, and other contaminations with which it may come in contact during the erection of a building. Several of the large paint manufacturers have developed special lacquers which will protect the sheet for a year or more from the effects of "building filth." The lacquer can be removed at the completion of the building, or it may be allowed to wear off from the effects of the weather.

The need of passivation has not been stressed in this discussion. Whenever steel rolls, steel dies, or shears come in contact with stainless, there is a possibility of discoloration due to a film of iron being abraded on its surface. This film should be removed either with the nitric acid passivation treatment or by buffing with approved compounds.

In many fabrication operations it is often necessary or desirable to employ a lubricant to avoid excessive scratching, especially where high finishes are concerned. Under such conditions, and even when dry forming is involved, the accumulated surface deposit must be removed before the equipment is shipped. If the lubricant or deposit has a grease base, it is best to wash first with a good solvent and wipe dry. This, while removing all the grease, will leave a thin oily surface film which can be removed by absorbing with finely bolted whiting. The whiting, or precipitated calcium carbonate, should be sifted on to the surface and wiped off with a soft cloth, a method which will bring out the true colour and lustre of the metal.

If the material is to be used for building trim, either interior or exterior, it will very likely be further polluted during the building period from other products, such as cement, dust, paint, lacquer, etc. It can be covered, of course, with a heavy Kraft paper applied with ordinary paper-hangers' paste and washed off when completed with warm water. If not thus protected, the surface should first be washed with benzol, turpentine, paint remover, etc., depending on the deposit in question, to remove heavy dirt. Never use steel wool, metal scraper, or any other mechanical method, as scratching and contamination of the surface are almost certain to result. Steel or iron particles may thereby become embedded in the surface and eventually oxidise to brown iron rust, making it appear as though the stainless were becoming discoloured, when, actually, the stainless is not affected in any way.

Final Washing

Follow this preliminary cleaning with a final washing, using half-and-half powdered 00 pumice and whiting on a soft rag wet with either plain water or water to which a little ammonia has been added. Always rub in the direction of the polishing lines—never with a circular motion or across the grain, as light scratches or light and dark areas may result. Remove excessive powder with a clean, wet rag, and allow the remainder to dry, then wipe off with a soft, dry cloth, preferably flannel.

LETTER TO THE EDITOR

Scarcity of Raw Materials

SIR,—The representations which are being received in increasing numbers from members of the Engineering Industries Association complaining of the scarcity of essential raw materials disclose a very disturbing situation.

It would appear from a study of the trade and navigation accounts for May that one of the contributory factors is the remarkable rate at which the export of raw and semi-manufactured materials has been increased, as the following representative figures (from pp. 156 and 164) show:

EXPORTS (PRODUCE AND MANUFACTURES OF THE UNITED KINGDOM)

	Monthly average, 1938	*May* 1946	*Five months to* 31/5/38	*Five months to* 31/5/46
Group C—Iron and Steel	*Tons*	*Tons*	*Tons*	*Tons*
Wire rods and bright steel bars	814	7,384	4,070	22,305
Angles, shapes and sections	5,617	16,533	28,085	67,390
Hoop and strip	3,115	7,460	15,574	34,994
Group D—Non-ferrous	*cwt.*	*cwt.*	*cwt.*	*cwt.*
Aluminium and alloys :—				
Sheets, strip, etc.	4,872	25,683	24,350	97,565
Brass and alloys of copper :—				
Plates, sheets, strip, etc.	12,482	40,699	62,412	170,300
Rods, sections, etc.	3,076	30,146	15,480	99,066
Copper :—				
Plates, sheets, strip, etc.	7,275	32,868	36,376	137,894
Tubes	2,165	6,060	10,824	37,271

The comparative figures for 1938 and 1946 above speak for themselves.

All these materials are in such short supply for the urgent needs of the home market that manufacturers who use them are being compelled to refuse further orders for weeks and months ahead, with the inevitable prospect of unemployment in some sections of the engineering industries. If there is a reason for the Government's action in permitting the immensely increased exports of raw and semi-manufactured materials, rather than the much more valuable finished articles, the product of British skill in manufacture, of which those materials form an essential part, engineers are entitled to know what it is. Can it be that the Chancellor of the Exchequer and the Treasury are not aware of the loss to the national revenue which the policy of the President of the Board of Trade entails If exports of these materials are to continue on a rising scale to the detriment of the manufacturing engineer, it is difficult to see how unemployment at home and loss of markets abroad can be avoided.—Yours faithfully,

DAVIDSON,
President.

Engineering Industries Association,
9 Seymour Street, London, W.1.
July 29.

European Zinc Production

Progress in Italy and Norway

REPORTS which have recently come to hand concerning the output of zinc in European countries formerly occupied by the enemy, relate mainly to the progress made in Italy and Norway.

In Italy the Marghera zinc foundry, near Venice, came into operation again at the end of April, and it is expected that the production of electrolytic zinc will soon be started again at the Crotone plant in Southern Italy, now that the requisite electric power is once more available. An output of 500 metric tons per month is expected. In 1939 the aggregate production of zinc in Italy was 36,000 tons, sufficient to meet home demands and at the same time provide a considerable margin for export.

The Norwegian company, Norsk Zink Kompaniet A/S, of Odda, which has the largest capacity for electrolytic zinc in Europe, is working at two-thirds capacity—present annual production being about 36,000 tons as against nearly 50,000 in 1936. Exports of zinc in 1945 fell to the low figure of 7157 tons (9391 in 1944), but the 1946 exports show a tendency to rise, the January amount being 1410 tons compared with 250 in January, 1945. Competition from British Empire sources has caused the selling price to fall, and considerable difficulty is being met with in arranging for the import of zinc ores from abroad. The company exports mainly to other Scandinavian countries, the Netherlands, and France.

Heat-treatment of Metals

New Developments in Russia

IN an article published in *Moscow News* of June 19, Dr. M. Lozinsky, winner of a Stalin Prize, describes the latest developments that have taken place in the Soviet Union in the heat-treatment of steel surfaces by the use of high-frequency current. This method, which is outlined below, is being introduced on a wide scale in Russian industry, a series of successful tests having been carried out.

The method consists in the immersion in water of both the metal to be heat-treated, and of the inductor. By the use of high-frequency currents, it is claimed that more durable surfaces have been produced than by previous methods. The new Russian method is described as a development of an invention made by V. Vologdin, Dr. G. Babat and the author a few years ago, the underlying principle of which has been the increase in the depth of the electric field passing through a metal with increasing frequency of the current. The introduction of this method has made it possible to achieve a remarkable standardisation and a speed-up of the whole heat-treatment process. Pinion gears, for instance, can now be treated in a mere fraction of the time formerly required. The Moscow Machine Tool Works have thereby reduced spoilage in heat-treatment to about 1 per cent., and at the same time they have saved 1000 tons of fuel oil per month. As a result of further improvements, the most complicated steel parts may be treated and the thickness of the tempered surface can be adjusted to a fraction of a millimetre.

Indian Aluminium

Progress Report

FROM the time when aluminium was first produced in India by the Indian Aluminium Co., Ltd., at its Alupuram reduction works, near Alwaye, Travancore State (*see* THE CHEMICAL AGE, 1945, *52*, 125), spectacular progress has been made in this industry, according to a recent report in the *Bombay Evening News*. To satisfy the country's war-time requirements, the company's rolling mills at Belur, Calcutta, and the fabricating units, produced a wide range of articles, from aircraft parts to hospital equipment. It is claimed that this factory, from the technical point of view, compares favourably with large American and Canadian plants, and, when its power needs have been completely met, will attain an annual output of 5000 tons of aluminium. Arrangements are now being made for production of alloys of the duralumin type.

The construction of the company's alumina works at Muri, Bihar (*loc. cit.*), is nearing completion, and these will have a capacity of 40,000 tons per annum, while it is further stated that the Aluminium Corporation of India, Ltd., Asansol, Bengal, has now started production with an annual capacity of 1000 tons, which is to be increased shortly.

Review of Chemical Finance—II

Trends of Earnings, Dividends and Share Values

by S. HOWARD WITHEY, F.Comm.A., etc.

(Continued from "The Chemical Age," July 6, 1946, p. 12)

SOME manufacturers of pharmaceutical products and fine chemicals propose to increase their capital to restore the drainage of E.P.T. which has run away with large sums in the war years, and owing to insufficient labour, containers and materials, and shipping space for exports, the leading firms have reported a decline in gross earnings for the past year.

B.D.H.

In the case of BRITISH DRUG HOUSES, LTD., the trading profit amounted to £351,921 in 1945, compared with £467,219 for 1944, but owing to a saving in taxation the balance of net profit was £5125 higher at £42,284, enabling the ordinary dividend to be restored to the pre-war 6 per cent. level. The company's products are supplied for the use of the medical profession, pharmacists, research workers, educational establishments and industrial laboratories throughout the world, and new capital requirements are connected with widespread plans. The present issued capital of £750,000 is made up of £350,000 in the form of 5 per cent. cumulative preference shares of £1, and £400,000 in ordinary £1 shares, and after adding £20,000 to reserve the forward balance is £334 higher.

	£
Brought forward from 1944 ...	19,447
Net profit: 1945	42,284
Disposable balance	£61,731
5 per cent. dividend on £350,000 cumulative preference £1 shares, *less* tax	8750
6 per cent. dividend on £400,000 ordinary £1 shares, *less* tax ...	13,200
Transferred to reserve	20,000
Carried forward to 1946	19,781
	£61,731

After adding additional expenditure during the year, and deducting depreciation, the fixed assets total £552,540, and interests in subsidiaries amount to £122,141. The current assets aggregate £1,532,912, providing a surplus of £328,332 over current liabilities. The highest and lowest market prices of the shares over the past four years are given below:

5 per cent. cum. pref. £1 shares	1943	1944	1945
Highest	25s.	25s. 1d.	26s.
Lowest	22s. 6d.	23s. 9d.	24s. 6d.
Ordinary £1 shares			
Highest	25s.	29s. 6d.	51s. 3d.
Lowest	19s.	21s. 6d.	28s. 9d.

Recently, the preference were quoted at 27s. 6d. and the ordinary at 70s.

Griffiths Hughes

During the financial year ended March 31 last, record profits were earned by GRIFFITHS HUGHES PROPRIETARIES, LTD., which controls E. Griffiths Hughes, Ltd., makers of Kruschen Salts and numerous other proprietary medicines, etc. After providing for foreign and Dominion taxation, the combined profits of the group amounted to £555,557, representing an increase of £118,780. Provision for taxation is £42,534 higher at £264,890, and the net profit balance after charging depreciation, etc., is £75,505 higher at £276,855. The parent company's income of £156,530 after tax compares with £11,695 for 1944-45, and the net profit balance of £151,773 represents an increase of £44,726, which enabled the ordinary dividend to be raised from 10 per cent. to 15 per cent. The company has a capital of £2,500,000, composed of £1,000,000 in the form of 5½ per cent. cumulative preference £1 shares and £1,500,000 in ordinary £1 shares, and the forward balance is slightly increased.

	£
Brought forward from 1944-45 ...	3606
Net profit: year ended March 31, 1946	151,773
Disposable balance	£155,379
5½ per cent. dividend on £1,000,000 cumulative preference £1 shares, *less* tax	28,875
15 per cent. dividend on £1,500,000 ordinary £1 shares, *less* tax ...	120,750
Carried forward to 1946-47	5754
	£155,379

The consolidated balance sheet shows current assets totalling £1,414,661, giving a surplus of £840,646. Highest and lowest market prices of the shares are shown below:

5½ per cent. cum. pref.	1943	1944	1945
Highest	22s. 4d.	24s. 3d.	26s. 3d.
Lowest	19s. 6d.	22s.	23s. 3d.
Ordinary £1 shares			
Highest	26s.	36s. 3d.	50s. 7d.
Lowest	18s.	22s. 3d.	31s. 3d.

At the recent price of 26s. 6d. the preference yield over 4 per cent., and at 61s. 6d. the ordinary return nearly 5 per cent.

Greeff-Chemicals

Including profit on the sale of property, the aggregate profits realised by GREEFF-CHEMICALS HOLDINGS, LTD., in 1945 was £37,765. This compares with £24,967 for 1944, and after providing £6500 for taxation and placing £7500 to reserve, the balance of net profit is £22,578, or an increase of £2421. The company owns all the issued shares of R. W. Greeff & Co., Ltd. merchants and distributors of industrial chemicals and other products, and the capital of £250,000 comprises £125,000 in the form of 5½ per cent. cumulative preference stock, and £125,000 in ordinary stock the dividend on which is now 12½ per cent.

	£
Brought forward from 1944 ...	15,042
Net profit: 1945	22,578
Disposable balance	£37,620
5½ per cent. dividend on £125,000 cumulative preference stock, gross	6875
12½ per cent. dividend on £125,000 ordinary stock, gross	15,625
Carried forward to 1946	15,120
	£37,620

Goodwill stands on the consolidated balance sheet at £167,672, and the current assets amount to £358,203, the floating surplus being £161,845, which compares with £118,779 a year earlier. At the recent price £148,779 a year earlier.

Profits from vegetable oil extraction and seed crushing are governed by the margins paid for processing, and the UNITED PREMIER OIL AND CAKE CO., LTD., receives payments from subsidiary companies under management agreements. In 1945 the trading profit and other income of the company amounted to £183,831, representing a decline of £5668 in relation to the previous year, and although the provision for depreciation and obsolescence is greater, the charge for taxation is smaller, and the balance of net profit is £5985 higher at £42,895. The company directly controls Alfred Smith, Ltd., and the Premier Soap Co., Ltd., and has a capital of £688,749, consisting of £491,874 in 7 per cent. cumulative preference £1 shares, and £196,875 in ordinary shares of 5s. on which a dividend of 15 per cent. has been paid for the past three years. After allocating £10,000 to reserve, the forward balance registers an increase of £94, thus:

	£
Brought forward from 1944 ...	47,306
Net profit: 1945	42,895
Disposable balance	£90,201
7 per cent. dividend on £491,874 cumulative preference £1 shares, *less* tax	17,216
15 per cent. dividend on £196,875 ordinary 5s. shares, *less* tax ...	15,585
Transferred to reserve	10,000
Carried forward to 1946	47,400
	£90,201

Fixed assets are shown on the consolidated balance sheet at £810,130, and the current assets at £813,923, the floating surplus being £357,097. The following are the highest and lowest market prices of the shares and of the 4¼ per cent. debenture stock over the past three years:

	1943	1944	1945
4¼ per cent. debenture stock			
Highest	103	103	105½
Lowest	100	103	103
7 per cent. cum. pref. £1 shares			
Highest	28s. 3d.	29s.	30s. 9d.
Lowest	25s.	26s. 3d.	28s. 9d.
Ordinary 5 shares			
Highest	12s.	15s. 4d.	18s. 7d.
Lowest	10s.	11s. 4d.	14s. 0d.

B. Laporte, Ltd.

As most of the products of B. LAPORTE, LTD., chemical manufacturers, were needed during the war, transition difficulties have not been great, and during the financial year ended March 31 last both gross and net earnings increased. The trading profit of £168,190 compares with £155,108 for 1944-45, and other income brought the total up to £195,144, or an increase of £13,265. At £130,000 the provision for taxation is £5000 up, and the pension fund receives £3000 more at £10,000, the balance of net profit being £7390 better at £52,644. The company has an issued captal of £476,000, divided into £6000 in the form of 6 per cent. "A" cumulative preference stock, £145,000 in 7½ per cent. "B" cumulative preference stock, and £325,000 in ordinary stock which receives a victory bonus of 2½ per cent., bringing the total distribution for the year up to 17½ per cent. After allocating £10,000 to general reserve, the carry forward shows an increase of £6329.

	£
Brought forward from 1944-45 ...	58,804
Net profit: year ended March 31, 1946	52,644
Disposable balance	£111,448
Dividends on preference stocks, at	5711
17½ per cent. dividend and bonus on £325,000 ordinary stock, *less* tax	30,604
Transferred to general reserve ...	10,000
Carried forward to 1946-47	65,133
	£111,448

Fixed assets appear on the balance sheet at £341,811, while the current assets amount to £684,398, the liquid surplus over current liabilities being £247,754, or £17,894 higher than a year ago. The market prices of the ordinary £1 stock units over the past three years are as follows:

Ordinary £1 stock units	1943	1944	1945
Highest	80s. 7d.	86s. 10d.	91s.
Lowest	73s. 1d.	75s.	82s. 6d.

Recently they were quoted at 96s., on which basis the yield is 3.6 per cent. At 35s. 6d. the "B" preference units return 4.2 per cent. An agreement to purchase a minimum 90 per cent. of the capital of John Nicholson & Sons, sulphuric acid manufacturers, has been announced.

British Alkaloids

For the twelve months ended March 31 last, the gross earnings of British Alkaloids, Ltd., manufacturing chemists and manufacturers of T.C.P., the well-known antiseptic, were returned at £169,810, this figure being arrived at after charging all general expenses and a proportion of the advertising expenditure. Although this represents a decline of £4916 in relation to the previous year, the provision for taxation is on a smaller scale, and the net profit balance of £56,911 compares with £51,144 for 1944-45, enabling the dividends on both ordinary and preference capital to be raised. The company has an authorised capital of £150,000, of which £91,002 has been issued and only £77,604 called up. This comprises £30,829 in the form of 8 per cent. non-cumulative participating preference £1 shares—which are entitled to one-quarter of the profits after the ordinary shares have received 8 per cent.—and £46,775 in ordinary shares of 1s.—the dividend on which is raised from 30 per cent. to 60 per cent. The balance of £29,075 is debited for advertising, and after charging £4682 for directors' additional remuneration, and allocating £2000 to staff pensions and £3000 to reserve, the forward balance is only £2592 smaller.

	£
Brought forward from 1944-45 ...	3831
Net profit: Year ended March 31, 1946	56,911
Disposable balance ...	£60,742
Advertising expenditure written off	29,075
Directors' additional remuneration	4682
Allocated to staff pensions ...	2000
Dividends distributed	20,746
Transferred to reserve	3000
Carried forward to 1946-47 ..	1239
	£60,742

After depreciation, the fixed assets have a balance-sheet value of £65,986, and the current assets total £234,574, the surplus of working capital being £55,857. Since the stocktaking date an E.P.T. refund to March 31, 1945, amounting to £38,237 has been received, and at the recent price of 14s. the ordinary 1s. shares yield over 4¼ per cent.

British Industrial Plastics

The demand for moulding powders made by British Industrial Plastics, Ltd., exceeded the company's capacity, and during the year ended September 30 last the productive capacity was increased. The trading profit and receipts from subsidiaries amounted to £280,681, which is an increase of £40,574 over the 1943-44 figure, but after charging £120,440 for normal expenditure, abnormal expenditure, and provision for taxation, the net profit balance was only £1811 better at £23,576. The company owns all the shares of the Beetle Products Co., Ltd., and the Streetly Manufacturing Co., Ltd., and has a capital of £444,712, made up of £14,820 in 10 per cent. tax-free cumulative preference shares of 2s., and £429,892 in ordinary 2s. shares which for the past four years have received a dividend of 8 per cent.

	£
Brought forward from 1943-44 ...	10,163
Net profit: year ended September 30, 1945	23,516
Disposable balance ...	£33,679
10 per cent. dividend on £14,820 cumulative preference 2s. shares, tax free	1482
8 per cent. dividend on £429,892 ordinary 2s. shares, *less* tax ..	18,915
Directors' percentage on dividend	688
Carried forward to 1945-46 ..	12,594
	£33,679

Properties and plant have increased, and the current assets have expanded, and the company will benefit from the reduction of E.P.T. During the past three years the ordinary shares have fluctuated between the following limits:—

Ordinary 2s. shares:—	1943	1944	1945
Highest	7s. 8d.	8s.	7s. 6d.
Lowest	4s. 11d.	6s. 3d.	5s. 9d.

At 7s. the shares return 2-3 per cent., and at the recent price of 5s. 6d. the preference yield about 6¼ per cent. gross.

Although there was a sharp fall in the gross earnings of Lacrinoid Products, Ltd. during 1945, due entirely to enemy action, the balance of net profit was £3828 higher at £9350, and the rate of dividend has been raised from 9 per cent. to 10 per cent. The trading profit of £18,988 contrasts with

£53,855 for 1944, but taxation absorbs only £8125 as against £47,000, and the increased dividend was earned with a margin of £2200, equal to a further 3.8 per cent. The company specialises in the manufacture of plastic accessories for the clothing, housing, and furnishing industries, and has increased its capital from £100,000 to £130,000 in the form of 2s. shares.

	£
Brought forward from 1944 ...	2633
Net profit: 1945	9350
Disposable balance ...	£11,983
10 per cent. dividend	7150
Transferred to reserve	506
Carried forward to 1946	4327
	£11,983

Freehold land and buildings, plant and fixtures are shown on the balance sheet at £71,107, while the current assets amount to £122,032 and provide a surplus of £62,220 over current liabilities.

British Xylonite

In 1945, the turnover of the BRITISH XYLONITE CO., LTD., was again more than double the 1939 figure, and the consolidated trading profit of the group was returned at £707,050. This compares with £618,876 for the preceding year, and after debiting depreciation, pensions, fees, and taxation, a consolidated net profit of £89,479 compares with £74,410. The dividends and interest received by the parent company, less administrative expenses, advanced from £77,415 to £97,475, and after charging pensions, fees and taxation the net profit balance was £7414 higher at £40,773, enabling the ordinary dividend of 10 per cent. to be repeated. The company's operations are conducted through B.X. Plastics, Ltd., Halex, Ltd., and Cascelloid, Ltd., and the paid-up capital of £700,000 consists of £400,000 in the form of 5 per cent. cumulative preference shares, and £300,000 in ordinary shares, all of £1, and the forward balance registers an increase of £15,773.

	£
Brought forward from 1944 ...	77,751
Net profit: 1945	40,773
Disposable balance ...	£118,524
5 per cent. dividend on £400,000 cumulative preference £1 shares, *less* tax	10,000
10 per cent. dividend on £300,000 ordinary £1 stock, *less* tax ...	15,000
Carried forward to 1946	93,524
	£118,524

The fixed assets are down at £770,595, while the floating assets total £2,136,712. This provides a working surplus of £1,082,523 over the current liabilities and provisions, compared with £1,069,870 previously. The ordinary shares are not quoted, but at the recent price of 24s. 6d. the preference shares yield more than 4 per cent.

Pinchin, Johnson

Satisfactory results were obtained in 1945 by PINCHIN, JOHNSON AND CO., LTD., the big paint combine, and the rate of dividend on the ordinary capital has been increased from 10 per cent. to 15 per cent. The trading profit of £583,116 compares with £555,756 for 1944, and after debiting £150,000 for E.P.T. and £132,000 for income tax, the net profit was £270,380. This compares very favourably with 1944 when the operations resulted in a deficit of £71,718 after providing an extra £180,000 for income tax. The company's capital of £2,626,250 is unencumbered by debentures and comprises £500,000 in the form of 6½ per cent. first cumulative preference shares of £1, £300,000 in 4 per cent. second cumulative preference £1 shares and £1,826,250 in ordinary shares of 10s., and as no special allocation is made to reserve the forward balance is £98,245 higher, as indicated below:

	£
Brought forward from 1944 ...	43,526
Net profit: 1945	270,380
Disposable balance ...	£313,906
Dividends distributed	172,135
Carried forward to 1946	141,771
	£313,906

Investments in subsidiary undertakings have a book value of £908,357, and other investments appear at £366,098. Altogether, the fixed assets aggregate £2,254,530, while the current assets amount to £2,244,254. The current liabilities and provisions total £749,125, so that the floating surplus is £1,495,129, which compares with £1,470,847 a year earlier. During the past three years the first preference £1 shares have fluctuated between 30s. and 35s. 9d., and the ordinary 10s. shares between 29s. 9d. and 42s. 9d., as follows:

6½ per cent. cumulative preference £1 shares.

	1943	1944	1945
Highest	33s.	34s. 6d.	35s. 9d.
Lowest	30s.	30s. 6d.	33s.
Ordinary 10s. shares.			
Highest	38s.	42s. 9d.	42s. 3d.
Lowest	29s. 9d.	32s. 3d.	34s. 3d.

At the recent price of 35s. the first preference return 3.7 per cent., and at 43s. the ordinary yield 3½ per cent. The second pre-

ference were recently quoted at 22s. to produce 3.6 per cent., and are a well-secured investment.

International Paint

Fresh high records for turnover and output were established by the INTERNATIONAL PAINT AND COMPOSITIONS CO., LTD. in 1945, and the distribution on the ordinary capital has been raised from 20 per cent. to 23 per cent. The trading profit of £231,886 compares with £210,895 for 1944, and income from investments brought the total up to £319,550 as against £291,638. The net profit balance after providing more for E.P.T. was £5871 higher at £150,474, and after meeting the dividend the surplus enabled £10,000 to be allocated to general reserve and £3000 to the development fund, and the carry-forward to be increased. The company specialises in the manufacture of anti-corrosive and anti-fouling compositions, paints, varnishes, etc., and has a capital of £734,500 and no debenture indebtedness. The capital consists of £200,000 in the form of 6 per cent. cumulative preference £1 shares and £534,500 in ordinary £1 shares, and the company has no serious reconversion problems to solve.

	£
Brought forward from 1944 ...	27,568
Net profit: 1945	150,474
Disposable balance ...	£178,042
6 per cent. dividend on £200,000 cumulative preference £1 shares, gross	12,000
23 per cent. dividend on £534,500 ordinary £1 shares, gross ...	122,935
Transferred to general reserve ...	10,000
Allocated to Development Fund ...	3000
Carried forward to 1946	30,107
	£178,042

Including a general fund of £370,000, the reserve aggregate £530,000, and goodwill has been written off. The balance sheet shows subsidiary and other trade investments at £191,225, while the current assets amount to £1,337,134. The highest and lowest market prices of the shares over the past three years are tabled below.

6 per cent. cumulative preference £1 shares.

	1943	1944	1945
Highest	32s.	32s. 9d.	33s. 6d.
Lowest	28s. 9d.	30s. 6d.	31s.
Ordinary £1 shares.			
Highest	6 3/32	6 7/32	6 11/32
Lowest	5¼	5⅜	5 11/16

Recently, the ordinary were quoted at 6¼ to yield 3.7 per cent., and at 33s. the preference return 3.6 per cent.

Trading and other profits of AULT AND WIBORG, LTD., and its subsidiaries were returned at £134,887 for the year to March 31 last, the amount attributable to the parent company being £121,853, as compared with £100,581 for 1944-45. At £63,575 the net earnings are nearly £20,000 higher, and the ordinary dividend has been raised from 12½ per cent. to 18 per cent.

	£
Brought forward from 1944-45 ...	33,786
Net profit: year ended March 31, 1946	63,575
Disposable balance ...	£97,361
Preference service	4000
18 per cent. dividend on ordinary capital	21,549
Allocated to staff account ...	9537
Transferred to reserve fund ...	20,000
Carried forward to 1946-47 ...	42,275
	£97,361

Joseph Crosfield

For 1945 the trading profit of JOSEPH CROSFIELD AND SONS, LTD., soap and chemical manufacturers, is shown at £1,166,055, which represents a decline of £42,085 in relation to the preceding year, but after charging depreciation, deferred repairs, fees, and taxation, the net profit balance is £4657 higher at £675,660. For the third successive year the ordinary shareholders received a tax-free dividend of 25 per cent., and the forward balance has been increased by £73,160. The company has a capital of £4,900,000 which comprises four preference issues totalling £3,400,000, requiring an aggregate dividend of £227,500, and £1,500,000 in ordinary shares.

	£
Brought forward from 1944 ...	302,131
Net profit: 1945	675,660
Disposable balance ...	£977,791
5 per cent. dividend on £400,000 cumulative preference shares, gross	20,000
6 per cent. dividend on £500,000 cumulative preference shares, gross	30,000
6½ per cent. dividend on £1,000,000 cumulative preference shares, gross	65,000
7½ per cent. dividend on £1,500,000 "A" cumulative preference shares, gross	112,500
25 per cent. dividend on £1,500,000 ordinary shares, tax free ...	375,000
Carried forward to 1946	375,291
	£977,791

The ordinary shares are owned by Lever Brothers and Unilever, Ltd.

A CHEMIST'S BOOKSHELF

LES RADIATIONS. By Professor Charles Fabry. Paris: Armand Colin. Pp. 220. 60 fr.

It is pleasant to welcome on to the bookshelf once again the neat little volumes of the Collection Armand Colin, the present publication (No. 243 in the series) being the posthumous work of Dr. Fabry, honorary professor at the Sorbonne and the Ecole Polytechnique. With his great specialised knowledge, he has brought system into the vast mass of accumulated facts concerning radiation of all types; and he has contrived to do so without artificial complications and without undue resort to abstruse mathematics. The book includes a critical study of the most up-to-date methods for producing, analysing, and measuring rays, as well as a detailed description of the necessary apparatus. The final section deals most usefully with the applications of radiation, not only on the biological side, in which so many important advances have been made in the last twenty years, but also from the point of view of chemical analysis and photochemistry.

INDUSTRIAL EXPERIMENTATION. By K. A. Brownlee. London: H.M.S.O. Pp. 116 2s.

This book, derived from a monograph written for the use of those concerned with pilot-plant experiments or chemical manufacturing processes in Royal Ordnance Factories (Explosives), will be generally welcome as a guide to both the planning and the interpretation of experiments on an industrial scale. The methods described can easily become part of the everyday technique of all who carry out similar experiments. The subject is treated entirely from a practical point of view and the book deals mainly with statistical methods, largely developed by Professor R. A. Fisher, expounded in his *Statistical Methods for Research Workers* and *The Design of Experiments*. Each method discussed is illustrated with examples and its practical use is facilitated by five appended tables.

In the author's opinion the masses of data accumulated by automatic recorders on modern chemical plants should prove a profitable source of information if analysed by these methods. Although such statistical designs have hitherto been employed in the chemical industry only to a very limited extent, their development has been pursued in agricultural science, where there is now a body of experience available stretching over twenty years. Certain aspects will need to be developed in the chemical industry, and others perhaps modified, but they will surely lead to useful conclusions. The book is written for the general reader and is welcome as a transition from war-time investigations to general industrial application.

SCIENCE NEWS, I. Edited by John Enogat. London: Penguin Books. Pp. 208. 1s.

The dissemination of scientific information to the general public is a much-debated question at the moment, and the present volume is not a bad way of starting such dissemination. The "Penguin" public is still pretty general, though it has a tendency to drift leftward and upward; and *Science News, I*, which is remarkably topical considering the inevitable delays of book-manufacture, and at the same time sufficiently varied, should reach quite a large proportion of the really "general" public. Apart altogether from the informative value of the contents, which is high, an important point is the revelation provided of the scientific attitude of caution—what the Foreword describes as "mild hedging"—a corrective to the categorical statements often appearing in the popular press.

Anyone interested in chemistry cannot fail to be fascinated by Sir Lawrence Bragg's famous lecture on "Metals," here reprinted, though it is unfortunate that Plates 4 and 5 have been transposed. Dr. D. D. Eley goes a long way towards providing a popular exposition of chemical reactions a far from simple task; and there are fascinating chemical details in "Danger! Dirt!", "Biological Front," and, of course, "Chemical Front," all of which are apparently anonymous collections of up-to-date facts. It seems a little hard, however, to describe the development of DDT, as an insecticide, as a "lucky guess," especially in view of West and Campbell's latest account of the work involved. Still, a most remarkable shillingsworth.

Parliamentary Topics

Paraffin Supplies

IN the House of Commons last week, the Minister of Fuel, replying to a question by Mr. Spence, said he had endeavoured to improve the supply of paraffin, but it was in short supply and he was unable to announce any relaxation of the restrictions.

Insulin Priorities

The Chancellor of the Duchy of Lancaster, in reply to a question by Mr. Pritt, stated that in the British zone of Germany insulin was supplied both to civilian internees and the general public through the German authorities. The Control Commission had laid down no priorities for its supply, nor was he aware of any adopted by the Germans. His information was that supplies were adequate to meet hospital demands in full; limited quantities were available for sale to the public in chemists' shops.

Personal Notes

DR. E. GREGORY, chief metallurgist to Edgar Allen & Co., Ltd., has been elected president of the Institution of Engineering Inspection.

MISS ANNE TEMPLETON LAMBIE was awarded the Vans Dunlop prize in Physics and Chemistry by the University of Edinburgh at the graduation ceremony on July 24.

MR. R. H. S. ROBERTSON and MR. A. G. CLEMENT, the authors of the article on peat which appears in this issue, have been in Germany on a BIOS team which is to report on the peat industry in that country.

DR. W. C. NEWELL, who was on the staff of the Brown-Firth Research Laboratories, Sheffield, until recently, has been appointed head of the steel castings division of the British Iron and Steel Research Association.

MR. M. W. THRING, who has been appointed head of the physics department of the British Iron and Steel Research Association, has been with the British Coal Utilisation Research Association since it began.

MR. A. HARVEY, F.R.I.C., acting hon. secretary of the International Society of Leather Trades' Chemists, has been appointed to represent the society on the National Committee for Chemistry of the Royal Society.

WING COMMANDER R. S. W. LE FEVRE, D.Sc., Ph.D., F.R.I.C., who has been head of the chemistry department at the Royal Aeronautical Establishment, has been appointed Professor of Chemistry in the University of Sydney.

SIR HENRY DALE, past president of the Royal Society, is to succeed Sir Richard Gregory on January 1, 1947, as president of the British Association. Other appointments already effective are: MR. M. G. BENNETT, treasurer; DR. E. HINDLE and SIR JOHN LENNARD-JONES, general secretaries; MR. D. N. LOWE, secretary.

PROFESSOR ALBERT SZENT-GYORGI, of the Chair of Medical and Organic Chemistry in the University of Szeged, Hungary, has been awarded the Cameron prize in Practical Therapeutics by the University of Edinburgh for his work in connection with vitamin C. Dr. Szent-Györgi is already a Nobel Laureate for his work on the vitamins, and his studies of muscular contraction are regarded as one of the major contributions to biochemistry.

MR. G. G. IBBOTSON, general manager of the heavy constructional division of Newton, Chambers & Co., Ltd., Sheffield, has accepted the board's invitation to become a local director.

DR. GWYN WILLIAMS, D.Sc., Ph.D., who is now a lecturer in chemistry at King's College, London, will succeed Professor T. S. Moore as professor of chemistry at the Royal Holloway College in the University of London, when the latter retires on October 1.

COLONEL R. G. DAWSON is resigning from the board of Metal Industries, Ltd., as he is taking up permanent residence abroad. The vacancy will be filled by MR T. MCKENZIE, managing director of Metal Industries (Salvage), Ltd.

MR. T. MAKEMSON, director of Iron Castings in the Iron and Steel Control, has been released by the Ministry of Supply and has returned to his post as secretary of the Institute of British Foundrymen. He is, however, continuing to act as honorary adviser on iron castings to the Ministry.

MR. F. TWYMAN, F.Inst.P., F.R.S., has resigned his position as managing director of Adam Hilger, Ltd., which he has held since 1902, to become technical adviser to the firm and to their associates, E. R. Watts and Son, Ltd. He remains chairman of Hilger's. His place as managing director is taken by MR. G. A. WHIPPLE, M.I.E.E., F.Inst.P., managing director of Watts, who is the son of Mr. R. S. Whipple, chairman of the Cambridge Instrument Company. Mr. Twyman came to Hilger's in 1898; became manager of the firm on the death of Mr. Otto Hilger in 1902; and managing director on the incorporation of the company in 1904. Mr. G. A. Whipple, after graduating at Cambridge, carried out research work in Germany and in this country. He has served on the council of the Institution of Electrical Engineers and has been hon. secretary of the Scientific Instrument Manufacturers' Association for the last six years. He is a member of the boards of governors of Northampton Polytechnic and the National College of Horology.

Obituary

From Luxembourg is reported the death, at the age of 69, of MR. GASTON BARBANSON, chairman of ARBED (Aciéries Réunies Burbach-Eich-Dudelange), and one of the principal founders of the iron industry in Brazil.

MR. ARTHUR FREDERICK WHITE, whose death has occurred at Heysham, at the age of 86, was a director of William White & Son, Ltd., manufacturing chemists and druggists, Bradford. Despite his advanced age, he took an interest in the firm right up to his death.

General News—— ——From Week to Week

A telephone service with the U.S.S.R.—at present limited to Moscow is now available between 10 a.m. and 1.15 p.m. daily.

The new College of Technology at Carlisle, to which will be attached a junior technical school, is to be given priority in the city's educational development plan.

Extensive new research laboratories, now in course of construction at the works of Edgar Allen & Co., Ltd., will, it is expected, be completed by the autumn.

The London Rubber Secretariat, formed by the U.K., French, and Netherlands Governments, is to begin publication of a new monthly statistical bulletin, of which the first issue is to appear shortly.

Details are given in the *Board of Trade Journal* for July 27 of the facilities which now exist for a limited number of business men to visit Germany for the purpose of looking into their property there.

Fierce heat from a fire at the Lancashire Tar Distillers, Ltd., Bootle, on Wednesday last week, split a 20-ton still, causing hundreds of gallons of tar to spill. Using spray jets exclusively, Bootle N.F.S. had the outbreak under control in 30 minutes.

Visits to chemical, metallurgical and other works will be arranged for those attending the International Technical Congress which is being held in Paris on September 16-21. Full details are obtainable from Mr. Robert Lowe, 82 Victoria Street, London, S.W.1.

Letters and packets up to a maximum weight of 1 lb., and printed papers, commercial papers, and samples up to the same weight limit, may now be sent to Austria. Correspondence must still be limited to business information.

A two-day conference on Design, which will be held under the joint sponsorship of the Council of Industrial Design and the Federation of British Industries, in the Central Hall, London, on September 26 and and 27, will be the first of a series in association with the "Britain Can Make It" Exhibition.

Damage estimated at £2000-£3000 was caused by flooding at the Bradford premises of the Sandoz Chemical Co., Ltd., during torrential rain which fell incessantly for five hours on Friday last week. The rise of water—which had been turned a deep violet due by contact with hundreds of kegs of powdered dyes—was stemmed by between 20 and 30 employees, who, working for about four hours, swept it into the well of a lift shaft, whence the N.F.S. pumped it to street level and into the beck.

Gall nuts and shellac consigned from any country may now be imported without a separate import licence. The Board of Trade announce that they have issued an open general licence to this effect.

The first number of a new periodical, *Austrian Science and Engineering Bulletin*, has been issued by the Association of Austrian Engineers, Chemists and Scientific Workers in Great Britain. The main article in this issue is the paper *Six Fundamental Principles of Modern Ceramics,* by Dr. Felix Singer.

Delegates of the countries represented at the Atomic Scientists' Association conference at Oxford last Tuesday agreed each to appoint one of their number as liaison officer for the exchange of information and ideas. Invitations are to be sent to countries not represented (including Russia) to nominate liaison officers.

Although it is estimated that 183 H.E. bombs—to say nothing of V1's and V2's fell within a short distance of their works at Bromley-by-Bow during the war, the works entirely escaped a direct hit, according to a booklet just issued by Kemball, Bishop & Co., Ltd., with the title "A Miracle at the Crown Chemical Works." It is a plain, unvarnished tale of fortitude and valour, but one that must make all who played a part in it feel rightly proud.

Foreign News

A Spanish firm is planning to erect an aluminium factory, in the Avilés district, for processing imported bauxite and for the production of a wide range of articles.

Extensive deposits of iron ore, with a metal content of 60 per cent., have recently been discovered by a Russian geological expedition in the southern parts of the Karelian-Finnish republic.

Magnesite from the deposits in the Sierra de Guadarrama is soon to be processed at Valladolid, Spain, where an annual production of 300 tons of magnesium is envisaged.

A monthly output of 10,400 tons of rolled products has been achieved by the Vitkovice Iron Works in Czechoslovakia, an increase of 19 per cent. over the monthly average of 1938.

Output of metal powder in the United States will amount to about 200,000,000 lb. next year, according to a statement made by the president of the U.S. Metal Powder Association. This quantity is about equal to the war-time annual rate. The present year's output, however, will not exceed 90,000,000.

The Government of India has removed the import duties on lead scrap, copper scrap, brass ingots, and brass scrap. The decision is subject to revision on receipt of the tariff board's report on the non-ferrous metals industry.

Large deposits of low-grade nickel are reported to have been found at Sibwesa in the Western Province of Tanganyika. The situation of the find is about 30 miles from Mpanda, where considerable quantities of lead, gold and silver are known to exist.

By the delivery of pyrites and sulphur from Italy, trade relations between that country and Czechoslovakia have been resumed. Italy is to receive cellulose and china clay for the ceramic industry of Tuscany.

The Norwegian Parliament has recently accepted the proposal, submitted by a Government commission, to erect ironworks at Mo in Rana, to produce about 200,000 tons of rolled iron products per annum. Construction costs are estimated at about 207,000,000 kroner, while 17,500,000 kroner are to be spent on the completion of the Glomfjord power station and on transmission lines.

According to official trade statistics for the first half of 1946, Switzerland exported chemical and pharmaceutical products valued at 174.6 million francs, as compared with 92.3 million in the first half of 1945. Exports of industrial chemicals totalled 21.5 (5.2) million francs, those of dyestuffs and indigo 75.3 (14.8), while pharmaceutical and cosmetic products rose from 42.3 to 77.8 million francs.

The Chilean Government has promulgated a decree whereby the Chilean State Railways are to take possession of the Nitrate Railway Co.'s railway system, thus implementing the expropriation degree of August, 1911. Valuation for indemnity purposes has been assessed at 79,383,877 Chilean dollars, and bonds to that amount, carrying 4 per cent. interest and 2 per cent. amortisation, will be due to the company.

A modern oil refinery, the first of its kind in Australia, is to be built at Paisley, near Altona, Victoria, by the Vacuum Oil Company at a cost of £A750,000, capable of treating over 15,000,000 gallons of crude oil yearly. With a few exceptions, equipment and plant will be manufactured in the Commonwealth, and large supplies of Australian-made chemicals will be used in the refinery processes. The plant has been designed so as to make it possible to treat crudes which might still be discovered in Australia, or as the result of exploratory work in New Guinea.

The Swedish iron concern, Avesta Järnverks A/B, intends to erect plants in the neighbourhood of Avesta and Krylbo, at an estimated outlay of about 32,000,000 kronor. An alloy mill, a steel plant, and a pressing mill are to be constructed.

Russian scientists report the discovery of deposits of copper, lead and zinc over a large area of the Altaisk region of Siberia. In the Northern Caucasus, lead and zinc ores have been found, and extensive tin deposits in Central Asia. Some of these deposits will be exploited next year. Over 500 geological expeditions are, at present, searching for non-ferrous metals in various parts of the country.

Industrial reconversion in the United States has brought about the greatest production of boron minerals since 1937. Production has steadily been increasing since the war-time low level of 226,723 tons in 1942, and last year's aggregate output was 325,935 tons. The United States is the world's main source of boron minerals, exporting, in normal times, one-third to one-half of the production.

The Mexican review, *Archivos Médico-Quirúrgicos y del Trabajo*, for April, has published a full-length translation of the Annual Report of the Inspector-General of Factories as abridged in THE CHEMICAL AGE on December 8, 1945. We are not fully informed about factory conditions in Mexico, but this is at least a proof of the interest of the local medical profession in their improvement.

The reconversion to peace-time activities of certain industries in Belgium appears to have caused some instability and friction in cases where the increase of output increases or of new establishments has gone so fast as to occasion an "embarras de richesse." Among the industries which are applying to the Brussels Board of Trade for permission to establish maximum rates of output is the "Association d'Acide Carbonique, Solide et Gazeux (Carbocide)," which is asking for authoritative measures to forbid any increase of productive capacity above that which existed on February 11, 1937, as well as any increase of output above the rate at the said date.

The July issue of *Aero Research Technical Notes*, published by Aero Research, Ltd., Duxford, Cambridge, describes Resin 70 and Resin 350 for wet strength paper.

"Alloy Structures Illustrated and Explained," and "The Production of Sound Copper Castings" are among interesting articles in the latest number of *Foundry Practice*, published by Foundry Services, Ltd., Long Acre, Nechells, Birmingham, 7.

Beecham Group

Expansion Policy

THE 18th ordinary general meeting of the Beecham Group, Ltd., was held in London on July 26.

Sir J. Stanley Holmes, M.P. (chairman and managing director), said that the trading profit for the year ended March 31, 1946, earned by the companies of the Group operating in almost all parts of the world amounted to £2,784,729, compared with £2,491,581 in the previous year.

Last year he stated that the Group, which consisted of over 100 companies and branches, had its plans laid for a rapid expansion of export business all over the world in the immediate post-war years. The increase in the profit on the export trade showed that that plan was already in operation and that they were making their contribution to the national export drive.

Throughout the world, and particularly in the British Commonwealth, they were strengthening their organisation and developing their trade. They believed that the result of their deliberations and decisions would considerably increase their overseas and export trade.

Last year it had been reported that they had recently entered the food market and had acquired the equity of C. & E. Morton, Ltd. During the past year the shares of further food companies had been acquired at a total cost, including Morton's, of approximately £1,000,000. They had registered a new company with a capital of £1,000,000, styled "Beecham Food Products, Ltd," to which the shares of all the food companies had been transferred. They believed that they had not only acquired businesses soundly established and with great prospects but that they had through them attached to the Group a number of men of great experience in the food trade. They were satisfied that the organisation of that new enterprise was proceeding on right lines and would be progressively successful.

The research investigations of the company covered four main fields—food, pharmaceutical, veterinary, toilet and cosmetics. The research department was proving its value more and more every day. The considerable increase in the sales of many of their products made further factory accommodation necessary. After conferring with the Board of Trade they had secured a site at St. Helens, where they already had their Beechams Pills factory, prepared plans and accepted a tender for the erection of a new factory, which they hoped would be completed by the end of 1947. They were also erecting a factory at Newcastle-on-Tyne and had purchased in the neighbourhood of London a factory used for war purposes.

The report was adopted.

New Companies Registered

Rylatt & Co., Ltd. (414,327).—Private company. Capital £1000 in £1 shares. Objects and directors similar to Organic Dyestuffs, Ltd. (*See below*). Registered office: 64 Fountain Street, Manchester.

Invex, Ltd. (414,663). Private company. Capital, £510 in £1 shares. Chemical and general engineers, etc. Subscribers: A. S. Wadsworth; G. A. Bailey, "Grangehurst," Bardsey, nr. Leeds.

English Overseas & Continental Food-products, Ltd. (415,127).—Private company. Capital £100 in £1 shares. Objects and other particulars similar to those of Anglo-European Overseas, Ltd. (*See below*).

Anglo-European Overseas, Ltd. (415,391). Private company. Capital £100 in £1 shares. Manufacturers, importers, exporters and dealers in chemicals, fertilisers, oils, plastics, etc. Director: A. Schwartz, 77 St. Gabriels Road, N.W.2.

M. & J. Chemicals, Ltd. (414,310).—Private company. Capital £100 in £1 shares. Manufacturers of and dealers in chemicals, disinfectants, etc. Director: Mrs. M. Braley. Registered office: 6 Broad St. Place, E.C.2.

Vermex Chemical Co., Ltd. (413,818). Private company. Capital, £2000 in £1 shares. Manufacturers of and dealers in chemicals, salts, acids, alkalis, etc. Directors: A. Walker; H. Quinn; J. Shaw. Registered office: 20 Queen Street, Blackpool.

G. M. File, Ltd. (414,821).—Private company. Capital, £100 in £1 shares. Manufacturers of and dealers in chemicals, gases, drugs, etc. Directors: G. M. File; A. F. File; R. L. Heard. Registered office: 1 Station Parade, Cherry Tree Road, Buckhurst Hill, Essex.

Marnisales, Ltd. (414,753). Private company. Capital, £100 in £1 shares. Manufacturers, agents for and dealers in chemical and allied products, etc. Directors: N. W. Holmes; A. S. Holmes. Registered office: Chapel Works, Chapel Street, Beeston, Notts.

Organic Dyestuffs, Ltd. (414,317). -Private company. Capital £1000 in £1 shares. Manufacturers of dyestuffs, pigments, chemicals and chemical auxiliary products for the textile, paint, rubber and leather industries. Directors: T. Rylatt, L. R. Wilkinson. Registered office: Pendleton Mills, Croft Street, Pendleton, Manchester.

Weed Control, Ltd. (414,080).—Private company. Capital, £2000 in £1 shares. Manufacturers of and dealers in insecticides, disinfectants, agricultural and other chemicals and fertilisers, etc. Directors: J. C. Gifford; E. M. Gifford; M. T. Gifford. Registered office: 53 Forest Road East, Nottingham.

Shell Chemical Distributing Co., Ltd. (115,699).—Private company. Capital £100 in £1 shares. Merchants, manufacturers and concessionaires of chemical and scientific preparations, etc. Subscribers: A. K. Gambier, L. G. E. Prime. Solicitors: Waltons & Co., 101 Leadenhall Street, E.C.3.

Accurti Maultasch, Ltd. (115,381).—Private company. Capital £1000 in £1 shares. General import and export merchants and agents, general chemists, etc. Subscribers: L. A. Evans; Miss B. Kesselman. Solicitors: Arboid & Co., 53/55, Piccadilly, London, W.1.

Surrey Chemical Co., Ltd. (414,588).—Private company. Capital £5000 in £1 shares. To acquire the business of a chemical merchant, etc., carried on by Geo. P. Page at 59 Cleveland Road, South Woodford, Essex, as "Surrey Chemical Company," and "S. F. Matthews & Co." Directors: Geo. P. Page, Mrs. E. E. Page. Registered office: 59 Cleveland Road, South Woodford, Essex.

D. K. (Chemicals) Ltd. (415,418).—Private company. Capital £4000 in £1 shares. To carry on business of dealers in the primary products of diketone; to adopt an agreement with Genatosan, Ltd., and John W. Leitch & Co., Ltd., and to carry on business of manufacturers of and dealers in dyes, chemicals, etc. Directors: A. G. Barthel; A. E. Everest; G. M. Dyson; M. Briscoe. Registered office: 43 Regent Street, Loughborough.

Company News

Bede Metal & Chemical Co., Ltd., earned net profit of £4,220 for 1945, as against £8,560 the previous year. The dividend of 6d. per share compares with 9d. previously.

Net revenue of £129,893 for the year to June 30 is reported by **Consolidated Tin Smelters, Ltd.** The figure for the previous year was £121,727. The ordinary dividend is unchanged at 2½ per cent.

The Zinc Corporation, Ltd., reports that gross revenue from products for 1945 was £2,136,132, as compared with £1,855,145. The total distribution on the ordinary shares for the year was equivalent to 1s. 6.75d. net per share, compared with 1s. 5.7d. per share.

The directors of **Benn Brothers, Ltd.**, proprietors of THE CHEMICAL AGE, have declared the following dividends, less tax, for the year ended June 30: 3 per cent. on preference shares, making 6 per cent. for the year; 15 per cent. on ordinary shares, making 20 per cent. for the year (last year 17½ per cent.); 4s. per share on the deferred shares (last year, 3s. 6d.).

Reagent Discoveries, Ltd., chemical manufacturers, etc., 75/77, Shaftesbury Avenue, London, W.1, has changed its name to Bryson Processes, Ltd.

Trading profit of **Morgan Crucible Co., Ltd.**, to March 31 last totalled £693,331, as compared with £618,514 for the previous year. The amount paid in ordinary interim dividend was unchanged at £40,462 and the final payments totalled £89,017, as against £80,925.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

CHEMO-PLASTICS, LTD., London, W.C., manufacturers of plastics. (M., 3/8/46.) July 8, £3240 mortgage, to Credit for Industry, Ltd.; charged on land with garage and other buildings thereon at Wrecclesham. *Nil. December 12, 1945.

SHEPHERD'S AEROSOLS, LTD., (formerly SHEPHERD'S BACTERICIDAL AEROSOLS, LTD.), London, E.C., manufacturers of machinery for air-disinfecting, etc. (M., 3/8/46.) June 29, £10,000 debentures; general charge. *Nil. December 31, 1945.

SOUTH WALES PLATING, LTD., Bridgend, chromium, etc., platers. (M., 3/8/46.) May 31, series of £1000 (not ex.) debentures, present issue £700; general charge.

Satisfaction

ANODISING & PLATINGS, LTD., London, S.W. (M.S., 3/8/46.) Satisfaction July 10, of mortgage registered April 25, 1942.

Chemical and Allied Stocks and Shares

THE opening of the Peace Conference tended to increase the waiting attitude in stock markets, business remaining at a low level in the absence of buying interest. Although there was again little selling, prices in most sections receded despite the firm undertone maintained by British Funds.

Sentiment in regard to industrial shares was affected by the serious coal situation, also by uncertainty as to dividend policy, the prevailing belief being that only a small proportion of benefits arising from E.P.T. reliefs and from the abolition of E.P.T. at the end of the year will be used for dividend purposes. The Chancellor of the Exchequer has previously indicated that in his opinion income arising from these sources should be placed to reserve; and he may not have abandoned the idea of a new tax to take the place of E.P.T. The impression in the market, however, is that in cases where dividends are below pre-war levels, there would be no objection to the latter being restored.

As was to be expected, shares of chemical and kindred companies have reflected the easier trend of markets. Imperial Chemical were 42s. 6d., Turner & Newall 90s., and Lever & Unilever moved down to 53s. 3d. Borax Consolidated have been steady at 47s. 9d., and the units of the Distillers Co. showed firmness at 135s., but, on the other hand, British Plaster Board declined to 33s. 3d., and Associated Cement to 68s. 10½d. British Match eased to 49s. 9d., and Dunlop Rubber receded to 72s., although the new debentures have strengthened to 4⅛ premium. United Molasses fell back to 53s. 10½d.

Movements among iron, coal and steel shares were small, but a few good features developed, notably Thomas & Baldwins 6s. 8d. ordinary, which rose to 10s. 9d. on the increased profits, the results being the first to cover a full twelve months of the merger represented by the company. William Cory strengthened to 95s. 3d., and, after an earlier decline, Ruston & Hornsby firmed up to 58s. 9d. Shipley eased to 34s. 3d., but Sheepbridge were better at 40s. 3d. Powell Duffryn, which continued to benefit from the statements at the recent meeting, were 23s. 7½d. In other directions, De La Rue at £12½ have receded following their recent advance, and British Industrial Plastics 2s. ordinary were 7s. 6d. Goodlass Wall 10s. ordinary came back to 30s. 7½d., Pinchin Johnson were 43s. 6d., and International Paint to £7 1/16. Paint shares generally showed moderate declines owing to news of the extent to which the industry is suffering from shortage of materials. British Aluminium were 42s. 10½d. Textiles remained dull, with few outstanding movements on balance. Bleachers at 14s. 6d. strengthened in anticipation of the forthcoming capital scheme, while Calico Printers were steady at 23s. 6d. awaiting the financial results. Courtaulds were 55s. 1½d.xd. and British Celanese 35s. Wall Paper Manufacturers deferred were 47s., and Triplex Glass steady at 41s., but Nairn & Greenwich eased to 83s. 9d. and Barry & Staines to 58s. 6d. British Drug were 56s. 3d., and W. J. Bush marked 89s. 4½d. British Thermostat changed hands at 21s. and B. Laporte at 98s. 9d.

Following their recent rise, Boots Drug eased to 63s. 9d., but Sangers were firm at 31s. 6d. on the victory bonus, and Timothy Whites active around 18s. 6d. Beechams deferred, however, came back to 25s. 9d. Oil shares recorded small movements, Anglo Iranian being 98s. 9d.xd., Shell 92s. 6d. and Burmah Oil 71s. 3d. Mexican Eagle Oil at 13s. 1½d. lost an earlier improvement.

British Chemical Prices

Market Reports

REPORTS from the London industrial chemical market show that the general position with regard to supplies and prices is practically unchanged. The holiday season has not been entirely without influence and there has been a slight curtailment in deliveries. At the same time a moderate volume of new business has been in circulation, and the demand on export account has not slackened. There are no items which call for special mention. The coal tar products market is comparatively quiet, with quotations very firm.

MANCHESTER. Firm price conditions obtain in virtually all sections of the Manchester market for both light and heavy chemicals. In spite of the influence of holiday conditions on deliveries to textile and other industrial consumers on the home market, reasonably active trading has been reported during the past week, replacement business coming forward freely as the need arises. The alkali products and other leading products are all finding a ready outlet among domestic users and a fair number of export inquiries have been dealt with during the past few days. A number of the tar products are in brisk demand, and there is a full absorption of supplies of creosote oil, carbolic crystals and certain other lines.

GLASGOW. Business has been maintained at a steady level in the home and export markets during the past week, with all classes of chemicals in considerable demand. Inquiries and orders have continued for both spot and forward deliveries at a normal rate. The export market continues to be brisk, with a considerable volume of inquiries which can hardly be met with the available supplies. Prices over the whole range have tended to increase. The present production is not in a position to meet the increasing demands.

Price Changes

Ammonia Bicarbonate.—MANCHESTER: £40 per ton d/d.

Oxalic Acid.—MANCHESTER: £5 per cwt.

Calcium Acetate.—MANCHESTER: Grey, £25 per ton.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Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Chemical reaction apparatus. N.V. de Bataafsche Petroleum Mij., and P. van't Spijker. 18912.

Hydrocarbons.—N.V. Internationale Hydrogeneeringsoctrooien Mij. 18901.

Nitro-anilines.—N.V. Polak & Schwarz's Essencefabricken. 18844.

Starch preparations.—N.V. W. A. Scholten's Chemische Fabricken. 18588.

Emulsifying materials.—L. M. Parr and R. J. Jay. 18507.

Fluid-flow governors.—A. Peet. 18564.

Thermoplastic sheet welding.—L. Rado. 18879.

Copper refining.—Revere Copper & Brass, Inc. 18280.

Ash utilisation.—T. E. Rule, and F. G. Mitchell. 18624.

Liquid seals.—P. M. Salerni. 18118.

Liquid dispensing apparatus.—I. C. P. Smith. 18629.

Synthetic resins.—Soc. l'Impregnation. 18387.

Production of brine ice.—C. P. J. Staal. 18405.

Gel particles.—Standard Oil Development Co., and J. C. Arnold. 18757.

Ethyl cellulose.—Standard Telephones & Cables, Ltd. 18738.

Heterogeneous plastics.—T. A. te Grotenhuis. 18863.

Dyeing of cellulose acetate.—Textron, Inc. 18433.

Esters.—Wingfoot Corporation. 18300.

Ultramarine.—American Cyanamid Co. 20203-4.

Hydro-forming of hexane.—Anglo-Iranian Oil Co., Ltd., C. B. Collis, and J. Owen. 20123.

Resinous compositions.—Bakelite, Ltd., J. G. Weighall, and E. G. K. Pritchett. 19867.

Electro-thermo-chemical process.—M. E. A. Baule. 20268-70.

Chemical photographic agents.—J. Bolsey. 19902.

Organic compounds.—J. G. M. Bremner, R. R. Coats, and I.C.I., Ltd. 19932.

Organic compounds.—J. G. M. Bremner, F. Starkey, and I.C.I., Ltd. 19931, 20154.

Hydrogenation of organic compounds.—J. G. M. Bremner, F. Starkey, and I.C.I., Ltd. 20304.

Organic compounds.—British Celanese, Ltd. 19748.

Synthetic waxes.—British Thomson-Houston Co., Ltd. 19940.

Resinous compositions.—British Thomson-Houston Co., Ltd. 20062-3.

Tetra allyl silanes. British Thomson Houston Co., Ltd. 20371.

Dyestuffs. Ciba, Ltd. 20016-7.

Dyestuffs. Ciba, Ltd. 20159-60.

Amides. Ciba, Ltd. 20161.

Dyestuffs. S. Coffey, N. H. Haddock, F. Lodge, J. Wardleworth, C. Wood, and I.C.I., Ltd. 19933.

Cathode ray tubes. A. C. Cossor, Ltd., L. H. Bedford, and W. H. Stevens. 20001.

Organic compounds. Distillers Co., Ltd., H. M. Hutchinson, R. R. Smith, and J. J. P. Staudinger. 20200.

Polymers.—E. I. Du Pont de Nemours & Co. 20203.

Vinyl esters. E. I. Du Pont de Nemours & Co., and N. W. Flodin. 20155.

Dihydropyran. E. I. Du Pont de Nemours & Co., and N. W. Flodin. 20156.

Plastic materials.—Expanded Rubber Co., Ltd., and S. Booth. 20085.

Treatment of plastics. J. Ferguson & Sons, Ltd., and S. A. Ede. 20053.

Complete Specifications Open to Public Inspection

Thermal treatment of strip or sheet made of aluminium base alloys. Aluminium Company of America. Dec. 5, 1944. 16154/46.

Obtaining and utilising protective colloids.—Carbonisation & Charbons Actifs. Dec. 22, 1944. 28062/45.

Imidazole compounds.—Ciba, Ltd. Dec. 21, 1944. 29975-6/45.

Resinous compositions. E. I. Du Pont de Nemours & Co. Jan. 1, 1945. 370/46.

Solid and semi-solid polymers and interpolymers of ethylene.—I.C.I., Ltd. Jan. 16, 1943. 853/44.

Solid and semi-solid polymers and interpolymers of ethylene. I.C.I., Ltd. Jan. 19, 1943. 1014/44.

Shaped polyamide products. I.C.I., Ltd. Jan. 4, 1945. 369/46.

Production of powder or sponge from metals or metal alloys by electrolytic reduction of metal oxides or other reducible metal compounds.—E. H. E. Johansson. Jan. 5, 1945. 521-2/46.

Distillation of heat polymerisable compounds.—Mathieson Alkali Works. Oct. 9, 1942. 16643/43.

Copolymers and process of producing same.—Mathieson Alkali Works. Jan. 9, 1945. 33669/45.

Catalytic oxidation process. Shell Development Co. Jan. 4, 1945. 11424/45.

Catalytically cracked gasoline.—Shell Development Co. Jan. 8, 1945. 31891/45.

Resin-coated articles.—Shell Development Co. Jan. 8, 1945. 31892/45.

Polymerising unsaturated organic com

pounds.—Shell Development Co. Jan. 9, 1945. 31893/45.

Insulin preparations.—Soc. des Usines Chimiques Rhône-Poulenc. Jan. 3, 1945. 35134/45.

Treatment of polysulphide polymers.—Thiokol Corporation. Sept. 14, 1943. 17637-8/44.

Complete Specifications Accepted

Catalytic isomerisation processes and reformed catalysts therefor.—Standard Oil Development Co. Sept. 13, 1941. 578,155.

Separation of acetone and butanol from fermentation liquors containing the same.—M. Sulzbacher. July 11, 1944. 578,279.

Derivatives of pantothenic acid. — G. Swain, F. L. Rose, and I.C.I., Ltd. Dec. 8, 1944. 578,251.

Manufacture of phenanthridine compounds.—L. P. Walls. Jan. 3, 1944. 578,226.

Process of making sulphaguanidine.—American Cyanamid Co. May 1, 1943. 578,682.

Polyethylene glycol compositions.—British Thomson-Houston Co., Ltd. July 19, 1943. 578,540.

Thermocouple apparatus for identifying metals.—British Thomson-Houston Co., Ltd. May 21, 1943. 578,569.

Manufacture of magnesium.—Canadian Industries, Ltd. Feb. 22, 1943. 578,670.

Methods of bright melting electrolytic tin plates.—Carnegie-Illinois Steel Corporation. March 8, 1943. 578,592.

Manufacture of polymers of acrolein oxime.—Distillers Co., Ltd., K. H. W. Tuerck, and H. J. Lichtenstein. Nov. 16, 1943. 578,598.

Process for the production of polymers and interpolymers of ethylene.—E. I. Du Pont de Nemours & Co. April 9, 1940. 578,584.

Production of urea-aldehyde compositions.—E. I. Du Pont de Nemours & Co. May 17, 1943. 578,643.

Manufacture of expanded thermoplastic resinous compositions.—Expanded Rubber Co., Ltd., A. Cooper, and D. E. Partington. March 13, 1942. 578,513.

Manufacture of expanded thermoplastic resinous compositions.—Expanded Rubber Co., Ltd., A. Cooper, and D. E. Partington. Jan. 10, 1944. (Addition to 578,513). 578,525.

Introduction into molten metals and alloys of other alloying elements.—Foundry Services, Ltd., and J. L. Francis. Dec. 6, 1943. 578,605.

Manufacture of *p*-aminobenzene sulphonic acid amides. J. R. Geigy A.-G. April 9, 1943. (Sample furnished). 578,564.

Method of plasticising rubber-like polymeric materials.—J. M. Huber Corporation. Aug. 16, 1943. 578,660.

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The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

BOUVERIE HOUSE, 154 FLEET STREET, LONDON, E.C.4

Telegrams: ALLANGAS FLEET LONDON Telephone: CENTRAL 3212 (12 lines)

GLASGOW: 116 Hope Street (Central 3970) BIRMINGHAM: Daimler House, Paradise Street (Midland 0784-5)

THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1415. August 10, 1946 Annual Subscription 21s. Overseas 26s.

Anglo-American Relations

IN devoting the Messel Memorial Lecture to the impact of science on Anglo-American relations, Dr. Wallace Cohoe ventured daringly into the difficult field of the relations between science and politics. There are not wanting those who declare that science, not politics, should govern the earth; who would see politicians displaced by scientists in the governing councils of the world. It is true that politicians are making a poor show just now, and that not only in this country; but whether any better show would be made by men of deep philosophical knowledge but without experience of government is at least doubtful. Politicians, for their part, decry the value of scientists in government, and generally maintain that scientists and technologists of all types should be at hand to advise their governments, but that no power should be entrusted to them. We have little doubt that the best practice lies midway between these extremes. If the House of Lords should be reorganised (we expressly rule out the expression "reformed") we shall confidently hope to see certain seats reserved for scientists, industrialists, and technical men of high reputation and achievement in order that the voice of science shall be heard in our legislative assemblies as a right, and not clandestinely in dark corners if anyone should happen to think of taking counsel from those who know the physical facts. In this hope we are greatly sustained by Dr. Cohoe's brilliant address.

Science, as Dr. Cohoe reminds us, advanced until it became dominant, and in late years, owing to the control secured over the release of atomic energy, predominant, in human affairs. That is an immense fact which must be given due weight by those who propose to govern the peoples of the world. Our own parliamentarians have gone some way towards recognising this in setting up the (unofficial) Parliamentary and Scientific Committee. Through that committee Members of Parliament are kept informed of scientific opinion. It may be questioned, however, whether it is of very much use to explain scientific facts to those without a certain basic knowledge of science; and while the present arrangement is better than nothing, it awaits the more general dissemination of scientific knowledge at our schools to have its full value.

It is of no use trying to control science. That is the kind of administrative *gaffe* which can so easily be made by those who do not recognise the facts. The only control that is

On Other Pages

possible in science is to leave it uncontrolled. There is no monopoly of brains, and if certain nations decided that scientists should take a holiday on the grounds that scientific discovery had outrun political and economic thought—and there are no other grounds on which we can imagine this attempt to be reasonably based other nations would leave science uncontrolled, and would soon reap the benefits of possessing greater scientific knowledge than those who would put their ostrich-heads in the sand of forgetfulness. The history of Germany in regard to the outlawry of war, and of both Japan and Germany towards disarmament, shows clearly what would happen.

These facts must be accepted, and what we have to decide is what measures we shall take in the face of them. To-day, the English-speaking nations are scientifically pre-eminent over all other nations. They have pre-eminence also in material production, thanks to their huge industrialisation. Atomic energy has enabled that pre-eminence to be maintained, but it exists in spite of this newer development of science. Dr. Cohoe speaks no less than sober truth, however, when he says that "it cannot be expected that this pre-eminent position can be maintained for any length of time unless our present position can be advanced continuously. The results of scientific studies are available to all and the scientific background of 1942 is available the world over. We must never forget that what the mind of one can conceive may be duplicated by another."

Science, however, is not concerned primarily with destruction or with the balance of material power in the political world. Science is ever working to perfect weapons against disease, to increase the sum of human happiness, to add to our knowledge of the universe. During the war that has just passed into history, the English-speaking nations of the world collaborated in all scientific and technical matters to an extent never before known. The result has been a surging forward of human knowledge and of human industry such as no generation has witnessed. Shall all this be thrown away now that peace has (theoretically) descended upon us? That is the question-mark that must stand clearly before the British and American peoples. The scientists would know how to answer it. Do the politicians know?

There have been examples during the year of peace that has been vouchsafed to us of the deterioration of political relations between allies. Nothing of this sort must be permitted to come between ourselves and the U.S.A. The English-speaking nations of the world must form a collaborative *bloc*, not in order to overawe the rest of the world, but as an example that in time shall show forth gloriously to all nations the value of mutual confidence that does not stop short of the fullest interchange of information. How this is to be brought about is a problem that must be solved. There will be in every nation individuals whose only regard is for their own selfish interests. We may call them "isolationists" or by any other name, but they will still be there and they will be loud in their protestations. The American loan indicates one form of collaboration and indicates also the dangers that beset attempts to put collaboration into practice. There are many who think the conditions of the loan are unsatisfactory. The British dislike borrowing, they foresee many years during which their income must be used to pay it back—with interest. But the fact remains that this country has come out of the war poor, and unable to buy at the same time sufficient food and the new machinery needed to get industry working again. The loan if expended wisely would enable us to buy from the U.S.A. the plant necessary to modernise our industries much more quickly than if we tried to manufacture it for themselves. Provided that we do not squander this money on imitation jewellery and other foolishness which the Government has announced its intention of importing from America, this loan will go some considerable way towards the rehabilitation of our industry, and in that sense it can be considered as in the same category as any business loan made by a private concern from its bankers.

This is an example of co-operation in practice, and we are convinced that it is the sort of co-operation that we should encourage a good deal more in the future. There will naturally be rivalries between American firms and British firms to obtain certain markets just as there will be equal rivalries between two British firms or two American firms. That is all to the good because it leads to a healthy spirit of competition. There are equally many other examples, and this is particularly so in the chemical industry, where American and British firms are pooling their ideas, their knowledge and their patents. The existing trend towards co-operation fully rein-

forces the more philosophic and political proposals made by Dr. Cohoe.

Dr. Cohoe's hopes lie in the direction of increasing friendly intercourse, of " a recognition of the value and use of the religious motive in human action " and in a common interest in the affairs of every-day life. The increasing speed of the aeroplane, which makes London and New York no farther apart than London and Southampton or Hull and Manchester were 100 years ago, is tending to increase the knowledge that peoples have of one another. Broadcast talks from one nation to another must assist. If, moreover, books, films, and other media of entertainment or culture are interchanged we may quickly achieve the valuable result of possessing some understanding of each other's points of view so that due allowance may be made for differences of opinion, differences of outlook, and different modes of expression. Dr. Cohoe rightly points out that in warfare the Americans and the British became ' one great family, vigilant, resourceful, co-operative, indefatigable, and successful." If this happy relation should be disturbed we shall go far towards encouraging further world wars and we shall undoubtedly set back the clock of progress by generations.

NOTES AND COMMENTS

The History of Chemistry

ALARMED at the increasing tendency towards specialisation, and the inclination of some of our younger scientists to know about one branch of one science only, a number of persons interested in education are advocating some sort of a return to humanism. The trouble is that nowadays, if a recruit to scientific industry is to succeed in his way of life, it is almost obligatory for him to specialise. What then is the solution? One suggested remedy, and not a bad one at that, is to encourage him to study the. history of chemistry. While not taking the student too far off his professional road, this study does undoubtedly give him an insight into the lives of men working in conditions very different from his own. His outlook is thereby broadened, and he can be saved from developing that tedious disability, the single-track mind. Nowhere has the single-track mind become a greater danger to progress than in the United States, the home of specialisation; and it is to the credit of the Americans that they have taken some steps to correct this defect. Leading in this field is that admirable periodical, the *Journal of Chemical Education.* Its monographs on great chemists of the past neglect no aspect of their heroes' lives, technical or non-technical; interesting pictures are included; and the whole effect is to give readers an impression of the continuity of their science. We have no idea how great the influence of this journal is upon scientific industry in the U.S.; we hope it is considerable.

The Chemistry of History

EVIDENCE of a rather different approach to the more humanistic side of chemistry is provided by an article in the July issue of *J. Chem. Educ.*, the author, Mr. E. R. Caley, being a member of the Department of Chemistry, Princeton University, and on the staff of the American Excavations in the Agora at Athens. The subject is " Ancient Greek Pigments," and the materials were examined by micro or semi-micro methods, the chief difficulty being the small amount of material available for analysis. The main sources were the scrapings of pigments from terracotta shards found in the ruins of the ancient market-place, and the remains of bulk pigments found in the vessels in which they had been stored or mixed. Most of the pigments were found to be natural mineral products used in their native state or after slight mechanical refining. Such processes as were used, *e.g.*, the mechanical separation of cinnabar, bear out the descriptions of Theophrastus in *De Lapidibus*, and the appearance of a fine blue frit, an artificial calcium copper silicate, argues an import trade with Egypt, since according to Vitruvius the first European manufacture of this material was at Puteoli, near Naples, in Roman Imperial days. White lead, however, was certainly made in Greece, again on the authority of Theophrastus. The point of all this, of course, is that the study, by chemical analysis, of these materials, leads to an appreciation of the commercial and industrial circumstances of another age and clime, and we

feel sure that Mr. S. W. Midgley, Jr., the student who worked under the author's direction, was grateful for this subject which was assigned to him for a thesis. We can never see the paintings of Apelles; but we can at least learn the mechanical handicaps he had to contend with.

Fluorine in Food

ON a later page of this issue it will be seen that the Ministry of Food has announced its intention of making an order limiting the fluorine content in certain ingredients in common use in the preparation of food. It may be asked why this order is proposed, and, if proposed, why the matter was not attended to earlier. Explanation is given in a report prepared by the Inter-Departmental Committee on Food Standards at the instance of the Ministry. The main food ingredient involved is calcium acid phosphate (A.C.P.), the majority of which—some 80 per cent.—in this country is prepared by a process using elementary phosphorus, resulting in a high degree of purity. In an alternative process, however, the raw material is rock phosphate, and the product is contaminated by fluorine compounds. During the war years manufacturers had to use such rock phosphates as were available, leading in some cases to a heavier contamination that was customary before the war. Some manufacturers, indeed, claim that they have been selling A.C.P. containing as much as 3000 p.p.m. of fluorine without exception being taken by the Food and Drugs Authorities. In 1943 the Society of Public Analysts recommended a maximum fluorine content for acid phosphates and similar food components, but it has proved difficult to convince a court that where these proportions were exceeded an offence had been committed.

Recommended Safety Limits

THIS was obviously an unsatisfactory situation, and to clarify it, manufacturers submitted, on request, a report of work carried out on their behalf by Mr. H. E. Archer and Mr. B. Leech, FF.R.I.C. In this report doubt was thrown on the contention that fluorine ingested in food is in any way toxic, and it was maintained that the absence in this country of any widespread mottling of teeth—claimed to be a highly sensitive indicator of fluorine absorption—it could be assumed that fluorine was not absorbed from A.C.P., or, if absorbed, was harmless. The committee, however, felt that further examination was required, and addressed a questionnaire on the subject to the Medical Research Council. As a result of this the points were made that (a) mottling is not the most suitable indicator of fluorine absorption except through the water supply; and (b) widespread fluorosis does occur in animals and humans in Algeria, a region from which rock phosphate is obtained. It was felt, therefore, that fluorine was a potentially toxic contaminant of food and that the risk to public health from the repeated ingestion of small amounts of the element was too serious to be disregarded. The difficulty was, in the absence of adequate evidence, to estimate the amount of fluorine that could be safely ingested over a period, and the recommended limits, which are more generous than those originally set by the Society of Public Analysts, have been made with due consideration of the probable total intake of the food ingredients concerned. A full report of the committee's procedure has been issued by the Ministry of Food.

University Grants Committee

AS has for some time been generally expected, the terms of reference of the University Grants Committee have been considerably broadened. In a written reply to a question in Parliament last week, Mr. Dalton, the Chancellor of the Exchequer, made an announcement to this effect, expressing his wish that the committee should take a fuller part in the planned development and rapid expansion of our universities. The new terms of reference go beyond inquiry into the financial needs of the universities, and the provision of advice to the Government on points concerning them; they include the acquisition and examination of information relating to university education both at home and abroad, and the rendering of assistance to the various bodies concerned in the preparation and development of such plans as may from time to time appear essential to ensure that the universities may themselves develop on a scale commensurate with national needs. Such terms open up a wide field of action to a vigorous committee; and it is to be hoped that present and future members will take advantage of the scope offered to them. The committee's record in the past has been good; our needs to-day are such that positive and strenuous action has become obligatory on any body responsible for the improvement of educational facilities.

Recent Developments in Analytical Chemistry—XVII

(from Our Analytical Correspondent)

As one of a series of spot tests for the detection of alloying elements in steels, α-benzoin oxime is recommended[1] as the reagent for copper. A drop of 5 per cent. ammonium persulphate solution in 5 per cent. ammonia is placed on the steel, allowed to stand until a brown precipitate forms, and then one drop of sulphuric acid (1 : 3) is added and allowed to remain for two or three minutes. The combined drop is then washed off, and the place where it had been is washed with acetone and allowed to dry. The reagent solution for the final test contains two parts of saturated ethanolic α-oxime, two parts of 0.88 ammonia, two parts of water, and one part of 50 per cent. citric acid. On applying a drop of this to the treated portion of the steel, a dirty green precipitate will form if copper is present. As little as 0.04 per cent. of copper in the steel can be detected, while a strong reaction is given if 0.9 per cent. of copper is present.

Separation of Copper and Cadmium

The method of Evans, Garrett and Quill for the separation of copper and cadmium in ordinary qualitative analysis[2] is based on the soluble copper tartrate complex which can be formed in alkaline solution; in the same conditions cadmium precipitates as the hydroxide. This method has been found[3] to be unreliable because of the ammonia which is present in the ordinary course of the analysis, which should be—but in general is not—completely removed on making the solution alkaline with sodium hydroxide. A variation in procedure is therefore proposed. After bismuth is precipitated by ammonia, as in the original procedure, the solution is acidified with nitric acid, taken to dryness, and heated to drive out ammonium salts completely. After cooling of the residue, it is dissolved in one or two drops of 6*N* nitric acid. One ml. of water is added, followed by ten drops of 6*N* sodium hydroxide and one ml. of 0.5 molar sodium potassium tartrate solution. Cadmium now precipitates completely as a gelatinous precipitate. In the presence of copper the precipitate will be blue in colour, but on washing twice with water the precipitate should now be completely white, indicating complete separation. On subsequently dissolving this precipitate in dilute sulphuric acid the cadmium may then be precipitated as sulphide.

An entirely different principle has been used by Bishop for the separation and identification of these two elements[4]. Using a small column of 8-hydroxyquinoline, 1 in. long, in a piece of quill tubing, inorganic chromatographic methods are brought into operation. The mixed neutral solution, of the strength usually met with in inorganic analysis, is passed through the column. The copper is removed as a greenish ring at the top of the column. If the column is now exposed to ultra-violet light, the cadmium compound, which fluoresces pure green, can be detected below the copper ring. Sufficient cadmium will also probably pass through into the filtrate to give the normal yellow sulphide precipitate with sulphuretted hydrogen.

Electrolytic Deposition of Copper

Sulphamic acid is recommended[5] for accelerating the deposition of copper in its determination in solutions containing nitric acid. The addition prevents interference from nitrogen oxides formed in the course of the electrolysis. In the case, for example, of a bronze, the alloy may be dissolved in nitric acid and tin filtered off. Lead and copper are then deposited simultaneously, sulphuric acid being added in the course of the electrolysis. Passage of current, at about 1.75 amp., is continued for about half an hour, and at this point 0.5 g. of sulphamic acid in 10 per cent. aqueous solution is added. Deposition is continued for a further 15 minutes. The electrolytic estimation of copper in bronzes is also dealt with by other authors. Rayner[6] describes its estimation, together with that of other elements, in a single sample of manganese bronze. A 2-g. sample is dissolved in a mixture of nitric and hydrofluoric acids. In such a medium, copper and lead may be separated quantitatively from stannic tin. Electrolysis, using 1 amp. for 30 minutes, should deposit all the copper on the cathode, lead appearing as the dioxide on the anode.

Normally, in such an acid medium, platinum is stripped from the anode and plated on to the cathode, giving erroneous results for copper. However, deposition of a lead dioxide coating on the anode prevents such action. Therefore it is recommended that if no lead dioxide appears on the anode in the first few minutes of the electrolysis (*i.e.*, lead is absent from the bronze) some lead nitrate solution should then be added to provide the protective coating. After half an hour sulphuric acid is added, and electrolysis continued till no further copper deposits. This can be observed by washing down with a little water, and watching the small ring of the cathode thus freshly

covered by solution. After washing with water and ethanol, the electrode is dried at 110° C. for two minutes and weighed. It is then stripped of copper and reweighed.

Instead of the hydrofluoric-nitric acid medium for solution, a perchloric-nitric acid mixture has been recommended for solution of a manganese bronze.[7] After solution, the whole is fumed down to remove the nitric acid. The solution in perchloric acid is then diluted considerably, and copper, tin, and lead are precipitated, using sulphuretted hydrogen. The combined precipitate is filtered off, ignited, and treated with nitric acid to separate the tin. The filtrate from this treatment is diluted, sulphuric acid and urea or sulphamic acid are added, and the copper is deposited electrolytically on a platinum gauze cathode. A current of 2.5 amp. is passed for an hour. Lead is deposited as the dioxide on the anode, and may be determined simultaneously.

Copper and Zinc Together

Copper and zinc may be determined together electrolytically in brass plating baths and allied materials[9]. This method, which is used as a routine control, first deposits the copper and zinc together from a cyanide solution containing ammonium sulphate and ethanolamine. The electrode is dried and weighed. The deposit is then stripped from the electrode by solution in a sulphuric-nitric acid mixture and, after partial solution, reversing the current to drive all the deposit into solution. The current is again reversed, and copper deposits. For the first minute 0.5 amp. is passed, and then the current is increased to 1.5 amp., deposition being complete in about ten minutes. On drying and reweighing the electrode, the weight of the copper is found. The weight of the zinc is given by the difference in the two deposits.

Perchloric-nitric acid mixture is used for the solution of aluminium alloys and high silicon alloys containing copper, which dissolve readily in this medium[9]. After solution, electrolysis is begun with a current of 2-3 amp., and the copper is deposited completely on a platinum gauze cylinder in 30-40 minutes.

The application of controlled potential methods, for which a relatively simple apparatus has been described,[10] has been applied to the estimation of copper in copper and tin base alloys.[11] The potential is maintained at the desired constant potential throughout the electrolysis. The alloy sample, weighing from 0.5 to 2 g., is dissolved in a hydrochloric-nitric acid (4:1) mixture, boiled, and 100 ml. of a solution containing 23 g. sodium tartrate, 1 g. urea and 10 ml. of 5*N* sodium hydroxide are added. The whole is diluted to 200 ml., 1-2 g. of hydroxylamine hydrochloride are added for anodic depolarisation, and electrolysis is carried out at a potential of -0.36 volt against standard calomel, for an hour. Using this method it is possible to determine accurately a few hundredths of a gram of copper in the presence of as much as 2 g. of tin.

Titration Methods for Copper

A rapid control method for copper in steel utilises a volumetric finish.[12] The sample is dissolved in a perchloric-nitric acid (1 : 1) mixture, and treated with a few drops of hydrofluoric acid to remove silica. Gentle fuming then removes the nitric acid. The solution is cooled and diluted, and the copper is precipitated as cuprous thiocyanate by treating with sodium thiocyanate and sulphurous acid, the solution being buffered with sodium acetate. The precipitate is filtered off, washed, and treated with chloroform, hydrochloric acid, and iodine monochloride. The whole is titrated against potassium iodate solution to the end point, when the pink colour in the iodine layer disappears.[13] The maximum error for this method is ± 0.02 per cent., and the whole determination can be carried out in less than 15 minutes.

Ammonium nitrosophenyl hydroxylamine (cupferron) has been found suitable as a reagent for the determination of copper by conductometric titration.[14] A sharp break occurs in the curve of conductivity plotted against mls. of standard aqueous cupferron, at the end point. The method is stated to be suitable for the determination of copper in brass if the tin content is not above 5 per cent. Zinc, nickel and cobalt have no effect on the accuracy of the titration. Iron, however, which also forms an insoluble compound with the reagent, should be removed. The reagent solution should be kept in the dark, and should be restandardised if it has been allowed to stand for more than three days.

Polarographic Methods

The polarographic analysis of aluminium alloys has been described by Kolthoff and Matsuyama.[15] The alloy is first attacked by 20 per cent. sodium hydroxide solution, and complete solution achieved in nitric acid (1 :1). Hydrochloric acid must not be used, as it interferes with the subsequent determination. To an aliquot of the solution gelatin is added, and the current is measured at + 0.15 and − 0.15 volt against standard calomel. These represent respectively the amounts of iron, and of iron and copper present, when corrected for the residual current given by a standard aluminium solution at the same potentials. If much iron is present, it is reduced by hydroxylamine hydrochloride, when the corrected diffusion current at − 0.15 volt represents the value for copper. Observation of the

current at + 0.2 volt will show whether there is still a trace of iron unreduced.

The polarograph has been used to determine copper in plant and animal tissues[16]. Such determinations have normally been associated with a preliminary ashing procedure. The present authors make use of the fact that in acid solution copper is released from copper proteins. Citric acid is used, and after the extraction the solution is buffered to *p*H 4 by adding sodium hydroxide, in effect forming a sodium citrate buffer. Copper is then determined polarographically, using fuchsin as a maximum suppressor, and heptyl alcohol to prevent foaming. Using this method, from 1 to 100 μg. of copper can be determined with an average deviation of $\pm$ 3 per cent.

Cranston[17] applies the same principle of extraction to traces of copper in milk and similar products. The sample is treated with perchloric acid to bring it to *p*H 1.0, releasing the copper from the proteins, and obviating the necessity for digestion or ashing of the sample. The filtrate from the acid treatment contains all the copper. An ion-exchange resin (Amberlite IR-100) is then used to remove the copper, the solution, neutralised with ammonia, being passed through a 150 $\times$ 12 mm. column of the resin. The copper is then stripped from the column by dilute hydrochloric acid, and determined polarographically. Amounts of copper up to 1 mg., which would be expected from 100 ml. of milk, are dealt with successfully. Alternatively, the determination may be completed photometrically, using dithizone, by a procedure already described in this series.[18]

An indirect polarographic method for copper has been described by Carruthers.[19] The method has been applied to extracts of copper in animal tissue. A measured excess of salicylaldoxime is added to precipitate the copper. The residual reagent is determined polarographically, thus enabling the copper content to be calculated. Since zinc gives a wave at about the same voltage as salicylaldoxime, it interferes with the determination. The determination has been applied to amounts of copper ranging from 4 to 600 μg. For the lower range an accuracy of about $\pm$ 3 per cent. is to be expected, while this is improved to about $\pm$ 1 per cent. with the larger amounts.

Colorimetric Methods

In synthetic ammonia plant it is necessary to keep a check on the cupric content of the ammoniacal copper solution which is used for absorption of carbon oxides. A method has been devised[20] which allows continuous recording of this value. The method is photometric, depending on the deep blue cupric ammino ion. A light beam passing through the solution is measured photoelectrically and the transmission recorded. In this connection, it has been found by Miller[21] that the blue cuprammonium colour, while dependent on the amount of ammonia present, and therefore troublesome to use by ordinary colorimetric methods, may be employed satisfactorily under certain conditions. The maximum absorption point for the colour is about 620 mμ, and if measurements are made with a spectrophotometer at this wavelength, the ammonia content has to be controlled very carefully. If, however, the measurement is made at 580 mμ, the absorption is independent of the ammonia content, and is an accurate measure of the amount of copper present. Based on this, Milner has devised a method employing this colour for the determination of copper in corrosion-resistant steel.

Spectrophotometric Methods

Traces of copper, for example in milk, can readily be determined spectrophotometrically using diphenylthiocarbazone.[22] The sample is decomposed by a sulphuric-nitric acid digestion, and an aliquot of the resulting solution is placed in a flask. The *p*H is adjusted to 2.3 (the yellow colour with cresol red) and a solution of the reagent in carbon tetrachloride is added. After transference of the copper, together with silver, mercury, and bismuth, to the organic (lower) layer by shaking, the upper layer is carefully poured away. Extraction of the remainder with acid potassium iodide solution transfers the interfering metals to the aqueous layer as complex iodides, so that after this is once more poured away, only copper dithizonate remains in the carbon tetrachloride. A pipette with a curved tip is used to draw off the last few drops of the aqueous layer The carbon tetrachloride solution is then measured spectrophotometrically at 520 mμ, and the copper determined from a calibration curve.

For the spectrophotometric determination of small amounts, from 0.025 to 0.2 mg. of copper, dithio-oxamide (rubeanic acid) has been proposed.[23] The copper solution, free from mineral acid, is buffered to *p*H 4.8 with acetic acid-ammonium acetate, and is treated with a 0.1 per cent. ethanolic solution of rubeanic acid. The olive-green colour may be measured spectrophotometrically at 400 or at 650 mμ. An accuracy of $\pm$ 0.1 p.p.m. is claimed.

Sodium diethyldithiocarbamate has been used for the determination of copper by a number of workers. Partridge,[24] determining copper in aluminium alloys, dissolves the alloy in a mixture of sulphuric, nitric, and hydrochloric acids (5 : 8 : 8), which has been diluted with about an equal amount of water. The solution is then heated till sulphur trioxide fumes appear, or to dryness. On cooling, the residue is dissolved in hot water. Nickel, if present, is removed from an aliquot of the solution by dimethyl-

glyoxime precipitation and filtration. A 0.1 per cent solution of the reagent is added, and the yellow complex is extracted with carbon tetrachloride. The extract is matched colorimetrically against standards, or read against a calibration curve. Results obtained agree closely with those obtained electrolytically.

The same reagent has been used for the colorimetric determination of copper in blood serum.[25] The copper is extracted from the serum by three successive treatments with trichloracetic acid, centrifuging, and decantation. The extract is then treated with sodium pyrophosphate, ammonia, and an aqueous 0.1 per cent solution of the reagent. The colour is determined photoelectrically. An average error of about 3 per cent. is found.

Finally, Strafford, Wyatt, and Kershaw have devised a scheme[26] for the determination of small amounts of metals in medicinals, in which copper is determined by the reagent. Two schemes are presented, the first dealing with copper, arsenic, lead, zinc, and iron. Because of the interference of bismuth with copper, these two elements are included in an extended scheme, together with cadmium and nickel.

Determination of Silver

As a confirmatory test for silver, Baker and Reedy[27] have proposed a test which is carried out on silver chloride precipitate. As applied to the silver analytical group, where lead and mercurous ions may also appear, the solution is precipitated with dilute hydrochloric acid, and chlorine water is added to oxidise mercurous to mercuric. The suspension is warmed to coagulate the precipitate, which is filtered off and washed till free from chloride, lead and mercury. The precipitate is then aspirated till it is practically dry, and a drop of a solution of potassium tetraiodomercurate is added. A bright orange colour will form with the precipitate obtained from a single drop of 0.001 molar silver nitrate.

The reagent, potassium tetraiodomercurate, is prepared by shaking 24 g. of mercuric iodide with 100 ml. of warm molar potassium iodide solution, and allowing to settle. The excess mercuric iodide, in contact with the solution, keeps the reagent stable for several months.

The volumetric determination of silver is described by Evans and Higgs.[28] Potassium cobalticyanide is used to precipitate the silver in the first instance. A quantitative separation from lead is obtained when the solution contains 5 per cent. nitric acid. The silver precipitate is washed with 1 per cent. reagent in 5 per cent. nitric acid, and is then dissolved in dilute ammonia. The final determination is carried out by a cyanide titration.

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German Technical Reports

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London's Chemical Industry

II. Fertilisers in West Ham

by W. A. PARKS, B.Sc., and E. A. RUDGE, Ph.D., F.R.I.C., A.M.I.Chem.E.

DURING the early years of the nineteenth century, West Ham, Stratford, and East Ham were villages, still in a rural setting. There were, however, the beginnings of industry in Stratford, near Bow Bridge, and, by the middle of the century, this industry was predominantly chemical. In earlier years still, Stratford itself had been the slaughterhouse of the metropolis. The coming of the railways, and the building of the Royal Victoria Docks in 1855, paved the way for a renewal of the trade in cattle. The district immediately east of Bow Bridge, and the newly developing area around the docks, enjoyed, or suffered, an influx of trades largely connected with the disposal of animal refuse.

In 1852, James Odams, of Holloway, took out a patent for treating liquid blood for the preparation of a manure. The blood from the slaughterhouse was treated in a lead-lined vessel, and into it was stirred commercial sulphuric acid. To this was added animal charcoal and mineral phosphate. When action had ceased, the mixture was taken out and allowed to dry, when it was ready for direct use as a manure. Odams had acquired land on the waterfront at Silvertown for use as a cattle market and slaughterhouse for imported cattle. In 1855, on a neighbouring site, his factory for the manufacture of this manure was opened, and began trading as the Patent Nitro-Phosphate and Blood Manure Company.

Sold to German Firm

As a result of an Order in Council concerned with the control of cattle plague, the landing of cattle was subsequently confined to Deptford, and Odams' slaughterhouse site was sold to a German firm controlled by Baron von Ohlendorff. This firm entered the rapidly expanding business of importing Peruvian guano, and their works were established in 1873. The fertiliser works of Odams continued, however, until about 1920, when they were sold, and the fertiliser business taken over by the Anglo-Continental Guano Works, Ltd., the direct descendants of Ohlendorff's. Ohlendorff's began by importing Peruvian guano in its raw state. It was brought over in sailing ships, and supplied to farmers as it was. The farmers found the stones, which were mixed with the guano, a great nuisance, and the firm, in consequence, began to screen the material before delivery. At a later stage it was both screened and bagged at Silvertown.

Although it had long been known that the nitrates were valuable additions to natural manures, and the work of de Saussure and Liebig had suggested the use of salts of ammonia for the same purpose, it was mainly the insistence of Liebig on the necessity for restoring the inorganic constituents of the soil that led to the increasing use of artificially prepared inorganic fertilisers. Liebig had shown that phosphates from bone or mineral sources could be rendered more effective by being made soluble with sulphuric acid. This work stimulated J. B. Lawes in his experimental work at Rothamsted. In 1843, Lawes established his Deptford works for the manufacture of superphosphate, and other such works followed. Evidence is lacking as to the earliest date of the manufacture of superphosphate in West Ham, but there were vitriol works in 1868, on what was called Plaistow Marsh, and at this works Gibbs, Bell & Company were certainly making superphosphate by 1874.

Superphosphate Manufacture

The Ohlendorff Company started making their own acid for superphosphate manufacture in 1880. The acid plant of this firm has already been described in a previous article (THE CHEMICAL AGE, 1946, *54*, 359). The method of superphosphate manufacture used at that time differed from the modern process mainly in the lack of mechanical contrivances. The crushed phosphatic rock was treated with sulphuric acid in dens, the earliest dens being sometimes of tarred pitch-pine and sometimes of brick. The Ohlendorff Company started with a horizontal mixer in which the rock was mixed with the acid. When mixing was complete, a door in the bottom of the mixer was opened, and the contents dropped into the den below. Here they remained overnight, and were then "picked" by hand, a particularly unpleasant task, since quite copious amounts of hydrogen fluoride and chloride are evolved during the maturing process. The whole process of maturing took from one to two months. In 1900 the firm introduced a new den of German pattern, with a capacity of 80 tons. Progress since that time has been in the direction of more complete mechanisation.

The firm remained German-owned until the 1914 war, after which it became a British company, and was absorbed by Fisons, Limited, in 1937. Old employees still remember the annual visits of Baron von Ohlendorff and his sons. These gentlemen, dressed immaculately in frock coats, after making their tour of inspection would

remove their white gloves and throw them to be scrambled for by excited and admiring work-people. With this gesture, partly perhaps of largesse, or even symbolic of the shaking of the dust of Silvertown from their persons, the important visitors made their departure.

In 1932, the Anglo Continental Guano Works, Ltd., now well established as a British concern, installed a complete plant

Fig. 1. A set of ancient retorts, dismantled before the war, and now demolished, formerly in Hunt's Charcoal Works. The original 1870 set were probably much the same as these.

of the American Broadfield pattern. They were the first in England to introduce continuous mixing and feeding. The feeding apparatus, designed to introduce the requisite quantity of ground rock into the mixer at the appropriate time, was designed at Silvertown and was patented in America. The advantages of this are more intimate mixing, and thus quicker maturing. The time for maturing has been reduced from one or two months to from three to seven days.

Other vitriol makers and manure manufacturers, such as Thomas Farmer, Mark Finch, and Henry Glover, operated works in the Silvertown district during the latter half of the nineteenth century, but these have now disappeared as separate entities.

Manure made from animal refuse has long been one of the main industries of West Ham and neighbourhood. The bone-boilers and soapmakers naturally disposed of some of their products in this way. Of these, in the last quarter of the century, there were many, but, as early as 1852 the only blood-drier mentioned in the London directories was one Richard Toms, of Bow Common, just on the London side of the River Lea.

Manures of this kind were prepared by Frederick Hempleman, of West Ham Abbey, from the 1860's onwards. Other firms, such as E. Cook & Son, who transferred their soap making to Stratford in 1859, and J. T. Hunt, utilised bones in their preparation. Hempleman was a blood-boiler. In fact, he was one of the last of his kind, for, although the simple boiling of blood was obsolescent by 1876, he was still practising this older process at his works. There were two methods of blood-boiling current at the time. One consisted of boiling the blood in a large pan by means of an open fire, the other utilised free steam. Hempleman used the latter process. The blood was first mixed with water, and, after boiling by injecting steam, the coagulated mass was strained from the liquid, and subsequently further dried by pressure. The residue was then either dried on a kiln heated by a fire beneath, or sold in the condition in which it came from the press.

The firm of J. T. Hunt, now Hunt's Charcoal, Ltd., was established in 1820 on the Thames side at Lambeth. As a result of an increasing stringency of local by-laws they left Lambeth in 1868, and moved to a site on the waterways near Bow Bridge. While at Lambeth they used local bones for boiling and for the manufacture of bone meal, at Stratford they began to import bones in addition to relying on local supplies. They produced superphosphate from bones, made bone meal, and, at one period, soap. Rumour has it that they also prepared phosphorus from bones. The apparatus was set up on the banks of one of the streams, and, in the event of fire probably a none too rare occurrence the plant was extinguished by the simple expedient of pushing it into the stream. At that time Stratford was still surrounded by agricultural land, and the fertilisers from this works were so popular that there would often be a long queue of farmers' wagons at the works awaiting their turn for supplies.

Bone Charcoal and Bone Meal

Shortly after the move to Stratford the production of bone charcoal was begun. This, and bone meal, are now the main products of the firm. The bones were originally burned in horizontal retorts very similar to the coke ovens of the gas works. The issuing gases were scrubbed to remove ammonia, and were then burnt in open jets to light the workshops. The ammoniacal liquor was treated in open tanks with sulphuric acid, and the sulphate disposed of as a fertiliser. The modern plant consists

of vertical retorts. Much of the charcoal is used in sugar refining.

Ammonium sulphate was produced from bones by S. Carey, of East Ham, about the year 1865. Local gas works did not treat their liquors at first. These were exported from the works, and some were used locally. The Gas Light & Coke Company, of Beckton, set up their sulphuric acid plant in 1879 (THE CHEMICAL AGE, *loc. cit.*), and started delivering sulphate in the same year.

Clay & Son, Ltd., are another old-established fertiliser firm in the neighbourhood. The founder, Samuel Clay, was a Colchester farmer who had experimented with various forms of fertiliser. In or about 1875 he established a works in Stratford to produce different varieties of fertiliser, mainly from blood, bones, and the like. The firm is well known for its agricultural and garden fertilisers.

Other smaller manufacturers existed, for more or less short periods, in the district. Legislation affecting the location of Offensive Trades had the effect of driving some of the older firms from sites nearer London, and the less stringent regulations in West Ham in these early days led many newcomers to try their fortunes in this type of business. Some of them, no doubt, were unsuccessful, and disappeared. But lest it be thought that West Ham remains to-day in the state in which Victorian writers described it, we hasten to add, in conclusion, that the activities of an energetic local authority, and of public-spirited firms, have reduced the nuisance value of the various works in this class of business to a negligible minimum. The firms which remain have long conducted their factories in an up-to-date and efficient manner.

Fig. 2. Hunt's Charcoal Works, Stratford, as they are to-day.

ACKNOWLEDGEMENTS

The writers wish to acknowledge, with thanks, their indebtedness to Fisons, Ltd., of Ipswich and Silvertown, Hunt's Charcoal Ltd., the Sanitary Inspector of the County Borough of West Ham, and Kelly's Directories for their kindly assistance

Oil Fuel for Chemical Plant

Lord McGowan's Plans for the Future

ADDRESSING Liverpool shipowners on Thursday last week, Lord McGowan, chairman of I.C.I., referring to the coal situation, said: "The position is so serious that we are considering not only converting many of our coal burners to oil, but using that form of energy in our great extension scheme." He pointed out that his company was now paying £3,500,000 more for its coal than in September, 1939, and stated that he had very good reason for saying that there could be no hope of any substantial improvement in output or reduction in price until 1950. The country as a whole, he thought, would be millions of tons short of the target figure for coal in April, 1947, and the coming winter would be a very trying one.

Speaking of the industrial situation in general, he warned manufacturers not to expect to export the same types of goods as before the war. "We must," he said, "apply our scientific, technical, and manufacturing experience to produce goods which other countries cannot manufacture for themselves." Although there was a general impression of prosperity at home, and we were "on the crest of a sellers' market," there were also many disturbing signs.

Of I.C.I. itself, Lord McGowan remarked that workers returning from the forces were showing a discipline and a desire to work which had been notably absent after the first world war. To break down the fears of unemployment and any atmosphere of suspicion, he urged industrialists to devote much more of the management's time to explaining things to employees: the balance sheet, marketing problems, expansion programmes, and the like—particularly in reference to the fuel problem. I.C.I., he said, were working on the development of light alloys, and were making a new leather-cloth product, "Vynide," with special flame-resisting properties.

Italian Chemical Notes

Improved Position

ITALY'S chemical industry is, according to reports recently received in this country, at present utilising about 25 per cent. of its pre-war capacity. This decline has been due to war damage on one hand and to the lack of coal on the other. However, repair of the war damage has made rapid progress and the prospect of an improvement in the fuel supply position now appears more favourable. An early revival of the country's chemical industry, leading to an increased output of products needed in general reconstruction work, is therefore being reckoned on.

Capital Increases

The report that two of Italy's leading chemical companies have decided to increase their share capital in the near future has to be related to the general improvement in the industry's position. According to the *Agenzia Economica e Finanziaria*, the board of the Montecatini group has decided to propose, at an extraordinary general meeting, an increase in the share capital from two to eight milliard lire by the issue of, 20,000,000 shares of 100 lire each which are to be offered to the shareholders in the proportion of one new share for each old share at a price of 110 lire. The remaining 4 milliard lire are to be derived from a revaluation of the group's assets and it is reported that Sig. Corbino, the Minister in charge of the Italian Treasury, has already consented in principle to this plan, by which the nominal value of the old shares is to be doubled.

The "Rumianca" Societa per l'Industria Eléttrica chímica e Mineraria," of Turin, has also worked out a plan to increase its share capital from 200 to 320 million lire, of which 100 million will be offered to shareholders, while the remaining 20 million will remain at the board's disposal for future "industrial combinations."

Rumianca's Progress

The company's report makes reference to the large sums that had to be expended for the reconstruction of the war-damaged plants at Apuania and Pieve Vergonte (in Novara Province), as well as for the purchase of equipment and raw materials which had been looted by the Germans. Whether or no these sums will be refunded by the State depends on the general settlement of war damage compensation, but the company hopes that by a revaluation of assets, and as a result of the capital increase, the company will be able to raise the necessary funds for future expansion of its activities. Furthermore, the company lays great stress on the financing of its plans without having recourse to bank credits. After last year's critical winter period had been passed, the company's development proceeded favourably and it is hoped that the revival of agriculture and the textile industry—within which are found Rumianca's chief customers—will lead to a further improvement.

German Patents

Allied Conference to Decide their Status

A CONFERENCE to consider the question of the future treatment of German-owned patents in Allied countries took place in London at the end of last month. Delegates attended from Australia, Belgium, Canada, Czechoslovakia, Denmark, France, Luxembourg, Netherlands, Norway, Union of South Africa, United Kingdom, United States of America. The chairman of the conference was Sir Harold Saunders, Comptroller of Patents in the United Kingdom.

Patents taken out by Germans exist in varying numbers in all countries of the world. Complete unanimity prevails among the Allied nations that in no circumstances shall any such patents within their territories revert to the former German owners, and the question as to how such rights shall in future be disposed of presents many difficulties. A strong sentiment prevails that it would be unfortunate if the continued existence of these patents should hamper international trade.

As a result of the discussions at the conference, the representatives of France, the Netherlands, the U.K. and the U.S.A. have signed an accord which will have the effect of making all patents of former German ownership now controlled by their Governments, and in which there was no non-German interest existing on August 1, 1946, available within their respective territories to all nationals of the countries party to the accord without payment of royalties or without any requirement to manufacture within the country where the patents exist. The representatives of Australia, Canada, Czechoslovakia, and the Union of South Africa have agreed to recommend to their respective Governments that the accord should also be signed on behalf of those Governments. Representatives of Belgium, Denmark, Norway, and Luxembourg feel that the special difficulties which exist in their countries render it necessary for their Governments to give the scheme a more detailed examination.

As stated above, the accord has been signed by four countries, and it remains open for signature by other members of the United Nations and by neutral countries until January 1, 1947. It will come into force as soon as it has been signed by these further countries provided they sign before the end of 1946.

British Patents in Enemy Countries

Statement by the Chartered Institute

ABOUT a year ago, the Chartered Institute of Patent Agents issued a pamphlet on "Enemy-owned Patents and Patent Applications"* which has now been followed by a pamphlet dealing with the complementary problems of "British-owned Industrial Property in Enemy Countries." This journal has published articles and comments on these problems† and some of the recommendations of the first-mentioned pamphlet have been considered in the Patents and Designs Act, 1946.‡ It will be interesting to see to what extent these new recommendations of the Chartered Institute come to be considered in the peace treaties.

These recommendations are briefly as follows: Following the example set by the Patents and Designs Act, 1946, the council differentiates between "The main agressors" (Germany and Japan) and other enemy, or enemy-occupied, territory, the latter being subdivided into: "the subservient aggressors" (Italy, Austria, Hungary, Rumania, Bulgaria, Finland) and "the overrun countries and merely technical enemies" (Czechoslovakia, Poland, Norway, Denmark, Holland, Belgium, Luxembourg, Greece, Yugoslavia). However, the recommendations of the Council group the "subservient aggressors" with the "main aggressors" as regards the sanctions to be imposed on them, while the Patents and Designs Act, 1946, grouped them together with the overrun countries (including France).

Arrangement with France

The patent relations between the United Kingdom and France have been settled by the Anglo-French Agreement of August 29, 1945, which left the way in which the terms for the extension of patents, claiming of priority, etc., were to be arranged, to the national legislation: this is in this country the Patents and Designs Act, 1946, the Patents, Designs, Copyright and Trade Marks (Emergency) Act, 1939, with numerous Statutory Rules and Orders, and the Emergency Laws (Transitional Provisions) Act, 1946; in France the most important laws are those of July 20, 1944 (providing mainly for the patents filed before January 1, 1939), and of April 2, 1946 (providing mainly for the patents filed after January, 1939). The Council suggests leaving it to the national legislation of the other liberated countries to make provisions most suitable to their internal legislation, and to conclude agreements with the United Kingdom on the model of the Anglo-French Agreement.

As regards the aggressors (main and subservient), the following recommendations are made:

(a) British applicants for patents, designs, or trade marks whose applications were pending on/or after September 3, 1939, should have the option to revive their applications without penalties.

(b) British-owned patents, etc., that were in force in aggressor countries on September 3, 1939, should be restored without penalties upon application of their owners.

(c) The normal terms of patents, etc., should be extended, without payment of additional fees, on application of their owners, to compensate for war losses.

(d) If the ordinary term for filing patent, etc., applications under the International Convention has expired since September 3, 1939, it should be extended.

(e) Licences, etc., imposed on British-owned patents, etc., without the owner's consent should be terminated at the will of the owner.

(f) Royalties, etc., which have become due since September 3, 1939, should be paid to the party in the United Kingdom to whom such payments would have been made but for the war.

(g) Actions for damages in respect of past infringements should not be precluded by the lapse of time.

(h) No "third-party rights" such as the right of user after the formal lapse of the patent, should be recognised.

(i) In the above, the word "Patent" should cover also the German "Gebrauchsmuster" and the Japanese "Industrial Design."

The German Danger

The reason why these suggestions extend to the main aggressor states and satellite states alike, while the Patents and Designs Act, 1946, applies to Germany and Japan only, seems to be because British patents, etc., owned by nationals of the satellite states are not considered to constitute a political or economic danger, whereas experience after the War of 1914-18 has shown that the restoring of German-owned patents was a great mistake.

On the other hand, no difference should be made in the protection of British-owned patent rights, etc., in any one of the former Axis states. The term "British" should, as under the International Convention, include also patentees, etc., permanently resident in the United Kingdom, who are not British subjects.

* THE CHEMICAL AGE, 1945, *53*, 205.
† THE CHEMICAL AGE, 1945, *52*, 147, 182.
‡ THE CHEMICAL AGE, 1946, *54*, 337.

Sulphuric Acid Production

Quarterly Statistical Summary

THE National Sulphuric Acid Association has published details relating to the production and consumption of sulphuric acid, etc., in the U.K. and Eire for the period April 1 to June 30, inclusive, and these are summarised in the following tables :

TABLE I.—SULPHURIC ACID AND OLEUM.
(*Tons of* 100 *per cent.* H_2SO_4)

	Chamber only	*Contact only*	*Chamber and Contact*
Stock, April 1, 1946 ...	34,156	25,154	59,310
Production	186,146	162,640	348,786
Receipts	42,074	26,882	68,956
Oleum feed	—	1,873	1,873
Adjustments	+88	+4	+92
Use	116,666	77,784	194,450
Despatches	110,863	109,653	220,516
Stock, June 30, 1946	34,935	29,116	64,051
Total capacity represented	220,290	180,870	401,160
Percentage production	84.5	89.9	86.9

TABLE II.—RAW MATERIALS
(*Tons*)

	*Pyrites**	*Spent Oxide*	*Sulphur and* H_2S	*Zinc Concentrates*
Stock, April 1, 1946	74,085	132,901	23,205	74,955
Receipts	88,949	56,878	69,089	27,070
Adjustments ...	+720	+2,677	+1,182	+3,215
Use	80,179	48,830	50,007	40,255
Despatches ...	138 25†	4,258 240†	270	538
Stock, June 30, 1946	83,412	139,128	43,199	64,447

* "Receipts" and "Use" include anhydrite "converted" to pyrites.

† Used at works for purposes other than sulphuric acid manufacture.

Note.—The above figures exclude all Government plants—*i.e.*, R.O.Fs., agency factories and other Government-financed plants.

TABLE III.—CONSUMPTION OF SULPHURIC ACID AND OLEUM
UNITED KINGDOM AND EIRE
(*April* 1 *to June* 30, 1946)

Trade Uses		*Tons 100%* H_2SO_4
60	Accumulators	2,054
61	Agricultural purposes	982
63	Bichromate and chromic acid ...	2,409
*64	Borax and boracic acid (*see* 105) ...	
65	Bromine	1,770
*66	Chlorsulphonic acid (*see* 105) ...	
67	Clays (fuller's earth, etc.) ...	1,585
68	Copper pickling	559
69	Dealers	3,401
70	Drugs and fine chemicals ...	3,053
71	Dyestuffs and intermediates ...	14,468
72	Explosives	3,079
73	Export	517
*74	Formic acid (*see* 105)	
75	Glue, gelatine and size	77
76	Hydrochloric acid	14,003
77	Hydrofluoric acid	636
78	Iron pickling (including tin plate)	17,459
79	Leather	1,262
81	Metal extraction	249
82	Oil (mineral) refining	6,001
83	Oil (vegetable) refining	1,321
84	Oxalic, tartaric and citric acids ...	1,689
85 & 80	Paint and lithopone	15,687
86	Paper, etc.	770
88	Phosphates (industrial)	990
89	Plastics, not otherwise classified	4,183
90	Rare earths	2,412
91	Rayon and transparent paper ...	27,796
92	Sewage	2,265
93	Soap and glycerine	67[illegible]
94	Sugar refining	228
*95	Sulphate of alumina (*see* 105) ...	
96	Sulphate of ammonia	60,689
97	Sulphate of barium	926
98	Sulphate of copper	7,283
99	Sulphate of magnesium	2,382
100	Sulphate of zinc	534
101	Superphosphates	116,160
102 & 62	Tar and benzol	3,547
103	Textile uses	4,417
105	Unclassified *Uses known ...	17,696
	Uses unknown ...	6,607
	TOTAL	353,283

Cornish Tin Mines

Appeal for Skilled Worsker

AN appeal for skilled miners, to make good the present shortage of labour in the only two tin mines now operating in Cornwall, was made by Mr. Harry Rich, chairman of the South Crofty Mine, at a recent meeting of the Cornish Chamber of Mines.

Urging that a special effort should be made to obtain more men in view of the fact that the Government is supplying the mines with the necessary money for development, Mr. Rich said his company was prepared to take on a hundred men at the South Crofty Mine at once. He suggested that steps should be taken to impress men returning from the Forces that good wages could be earned in the tin mines. The Ministry of Fuel, to whom it had been suggested that Polish miners who did not wish to be repatriated could be given work in the Cornish tin mines, had pointed out that there were difficulties of accommodation for such men, but Mr. Rich thought the now disused W.A.A.F. station near Portreath could be taken over for them.

Mr. G. W. Simms, chairman of Geevor, Ltd., also spoke of the necessity of obtaining more skilled workers, or trainees.

The Chamber agreed to write to the Minister of Fuel, welcoming the recent appointment of a Government committee to investigate the tin mining industry and offering assistance in its inquiries.

New Control Orders

Aluminium and Light Alloys

GOVERNMENT control of the purchase of aluminium and light alloys is removed with effect from August 1, under two orders made by the Ministry of Supply: the Control of Aluminium (No. 7) Order, 1946, and the Light Metals and Alloys Fabrication (No. 2) (Revocation) Order, 1946 (S. R. & O. 1946, Nos. 1269, 1270). As the Ministry has made a contract for the supply of 215,000 metric tons of virgin aluminium from Canada during the years 1946-1947, it will continue to be the sole buyer and seller of virgin aluminium.

The Ministry is also cancelling directions previously issued to the light alloy industry requiring the segregation of light alloy scrap into various categories, and the making of statistical returns. Arrangements have been made for statistics to be furnished on a voluntary basis by the industry, and totals will be issued monthly by the Ministry of Supply for publication. Inquiries should be made of the Light Metals Control, Ministry of Supply, Southam Road, Banbury, Oxon.

Chemicals in Food

Fluorine Content

AS a result of recommendations made by the Inter-Departmental Committee on Food Standards, the Ministry of Food has under consideration the issue of an Order under Regulation 2 of the Defence (Sale of Food) Regulations, 1943, prescribing limits, as under, for the fluorine content of the following foods:

	Parts per million
Calcium acid phosphate and sodium acid pyrophosphate when used for food purposes	300
Baking powder and golden raising powder	100
Self-raising flour and other food products containing aerating ingredients	8

Comments on these proposals should be forwarded in writing to the Ministry of Food, Miscellaneous Food Products Division, 39-40 Portman Square, London, W.1, not later than August 31.

Calcium Carbonate in Flour

The Minister of Food announces that on the advice of the Special Diets Advisory Committee of the Medical Research Council, from Sunday, August 11, the rate of addition of calcium carbonate (creta praeparata) to national flour will be increased from 7 oz. to 14 oz. per sack of 280 lb. This is to compensate for the increased phytic acid content of 90 per cent. extraction flour.

Digest of Statistics

Chemical and Allied Figures

AN improvement in the production of chemicals in the U.K. during May is recorded in the recently-published July issue of the *Digest of Statistics* (H.M.S.O., 2s. 6d. net). The figures quoted are in thousand tons.

Sulphuric acid production, which, after rising to the record figure of 165.1 in March, dropped to 160.3 in April, recovered in May to 164.3, and superphosphate production, which, after reaching 88.1 in March, fell in April to 84.5, climbed in May to 95.4, which is higher than it has been for any month in more than ten years. On the other hand, the production of compound fertilisers, which rose in April to 146.0 after being 138.3 in March, dropped to 116.0 in May.

Consumption of pyrites remained about the same, the May figure being 18.5 as compared with 18.0 for April and 19.1 for March. The consumption of sulphur for the manufacture of sulphuric acid likewise showed little change: for May it was 17.9, as against 17.0 for April and 16.8 for March. Spent oxide consumption remained almost unchanged, the figures for March, April and May being 16.6, 16.4 and 16.5 respectively. An increase is recorded for sulphuric acid consumption—176 for May as compared with 158 for April. The consumption of phosphate rock for fertilisers, which dropped from 68.6 in March to 62.3 in April, rose in May to 70.3. Superphosphate consumption fell to 111.9 in May, after being 116.8 in April and 128.1 in March. There was a slump in the consumption of compound fertilisers, the May figure being 101.3 after the record April figure of 231.1 and the March figure of 217.0.

Stocks of pyrites, recorded at 82 in April, again reached the March figure of 84 in May, and stocks of sulphur for the manufacture of sulphuric acid rose even higher than previously, reaching 69.3 in May after being 59.0 in April and 39.3 in March. Stocks of spent oxide also went up, the May figure appearing as 138.5, as compared with 134.6 for April and 132.7 for March. There was a slight improvement in the position of ammonia stocks (excluding ammonia produced in by-product factories and converted directly into ammonium sulphate): the May figure was 3.59, in comparison with 3.26 for April and 3.07 for March.

Iron ore production dropped from 245 in May to 226 in June, but pig iron production went up slightly—from 151 in May to 152 in June. Virgin aluminium production, which reached 3.29 in April, dropped in May to 2.53 (the June figures are not available).

The estimated number of people employed in chemical and allied works rose slightly, the figures (in thousands) being: April, 225.3; May, 226.9.

Jubilee of Hoffman-La Roche

50th Anniversary of Formation

(from a Correspondent)

THE Swiss chemical and pharmaceutical company, F. Hoffman-La Roche & Co., Basle, well known all the world over for its pioneer work in a number of important fields, has recently celebrated the 50th anniversary of its foundation by Frederick Hoffman. In 1896, industrial production of pharmaceutical and allied products was still in its infancy, and it required more than the usual degree of enterprise to lay the foundation of an industry in a limited domestic market such as that of Switzerland, a country which has to import the largest part of its raw-material requirements. As the co-founder, Dr. Emil Barell, who could look back on his 50th year as president of the board of administrators, pointed out in a speech delivered at the anniversary celebration, the company had never sought the support of any major international chemical group.

Secrets of Success

The company's location in Basle, a town and inland port which had for centuries maintained close literary and commercial contacts with all the world, had been of beneficial influence to the young company, leading, in conjunction with hard work based on systematic scientific research, to a highly developed export trade. As a matter of fact, 95 per cent. of the company's sales before the war had been in foreign markets. However, there had also been critical periods, such as the sudden elimination of the vast Russian market after the 1914-18 war, which entailed heavy financial losses to the company.

Referring to the position held by Swiss industry, Dr. Barell pointed out that it has to buy all raw materials in world markets and that it does not produce goods which are not also at the disposal of other nations. To this he added comments which can well be applied to post-war conditions in this country. In order that Swiss industry might grow and prosper, the president emphasised, it had to depend solely on its own strenuous work, and because of its distinctly less favourable position, compared with foreign competitors having access to rich natural resources, Swiss industry had to put in relatively more work in order to be equal or superior to world market conditions. Instead of reducing the wage rates in order to discount the high cost of production, Swiss industry had only one road open: to overcome the high-cost handicap by the special quality of its products. In addition, it had either to find ways of producing new products of such high standard that they brought a higher price, or else to develop processes of producing known products at lower cost. Industrial research, the speaker maintained, was "not merely mental enjoyment, but the direst necessity if employment at a sufficient remuneration was to be maintained."

Professor A. von Muralt, of Berne, made due acknowledgement of the company's contribution to the progress of science.

Major Scientific Achievements

To make brief reference to some of the company's major scientific achievements, its production, in 1904, of Digalen, the first digitalis preparation capable of being injected, marked a milestone in pharmaceutical history. In 1909, a soluble preparation, containing all the opium alkaloids in a constant relation, was marketed under the name of Pantopon. A number of opiates and sedatives and other products followed, until in 1931 the company's pride, Prostigmin, was produced which, as Dr. Mary Walker discovered in this country in 1935, yielded excellent results in its stimulating effects on the muscular system.

After Professor Reichstein carried out the first laboratory synthesis of vitamin C in Zürich, the company took in hand the technical adaptation of the process, and in 1933 it marketed the first synthetic vitamin. Since then it has produced, by synthesis, practically all the known vitamins, partly as the result of work done in its own laboratories or in co-operation with university laboratories.

Endowment of Research

Allusion must also be made to the company's decision to endow two important foundations. In order to promote scientific research by team work in Switzerland, the sum of 2,000,000 francs has been set aside for the Fritz Hoffman-La Roche Foundation, which will not only be a memorial to the work of the company's founder, but will also enable Swiss scientists to approach a problem simultaneously from various angles. Furthermore, the sum of 1,000,000 francs, contributed jointly by the firm, by Dr. Barell, and by another foundation, will establish the Emil Barell foundation for the Training of Chemical Engineers. This foundation will make it possible for the well-known Federal Technical Institute at Zürich (E.T.H.) to institute a new chair of chemical engineering. Chemical engineers are much in demand to-day, and the comment was made that unless Switzerland takes steps to train such experts herself, both the standard and the reputation of her chemical industry may, in the long run, be impaired.

Parliamentary Topics

Removal of Fuel Oil Duty

In reply to a written question from Mr. Scott-Elliot on Thursday last week, the Chancellor of the Exchequer said that, after consultation with the Minister of Fuel and Power, he had decided to propose in next year's Finance Bill that the import duty of 1d. per gallon should be removed from heavy fuel oil and gas oil. Mr. Dalton added: "From October 1, until the date when the import duty is removed, a subsidy of £1 per ton will be paid to consumers in this country of such oils, whether imported or home-produced. The procedure for paying this subsidy and the precise grades of oil to which it will apply will soon be announced. These arrangements will afford an appreciable relief against the higher operating costs of oil-burning plant as compared with coal-burning plant, and I hope they will result in conversions from coal to oil to the maximum extent possible."

[In a subsequent statement the Minister of Fuel and Power said that steps were being taken to encourage conversion of plant temporarily from coal burning to oil-fuel burning where it was clear that this might be done with advantage to relieve the pressure on coal supplies. Every assistance would be given to industrialists to make the change as speedily as possible. Regional officers were now consulting industrial undertakings where plant conditions were suitable for conversions, and special attention had been paid to continuous process industries. Direct applications from consumers for conversion to oil firing were being authorised though, with a few exceptions, the quantity of oil involved in each case would be relatively small.]

Potash

Mr. D. Marshall asked the President of the Board of Trade whether he was aware that 62,000 metric tons of potash fertiliser had been exported from the British zone in Germany up to July 1, 1946, and that only 17,000 tons were sent to the U.K.; and, as potash was in short supply in England and urgently required in the interest of agriculture, whether he would endeavour to obtain a higher proportion of the available export.

Mr. Driberg asked the President of the Board of Trade whether he was aware that fruit growers and other agriculturists in this country were in urgent need of potash fertiliser; and whether he would endeavour to secure a larger percentage than hitherto of the supplies of it available for export from the British zone of Germany

Sir Stafford Cripps replied that world supplies of fertilisers during the year ended June 30, 1946, were allocated among consuming countries by the Combined Food Board in Washington, and supplies for the current season had been allocated by the International Emergency Food Council. Under the latter allocation, all potash produced in the British zone of Germany would be retained for use within the zone, but the U.K. would be entitled to obtain from other sources a quantity sufficient to cover its estimated requirements. Every effort would be made to do so.

Soap Substitutes

Mr. William Shepherd asked the Minister of Food why the largest manufacturers of the basic material for soapless detergents were required to export so much of their production as to cause them to lessen supplies to the domestic market.

The Minister of Food replied that while the present soap shortage lasted exports of the raw material for soap substitutes would, as from August 15, be restricted to token quantities. More soap substitutes in general would become available.

Barytes and Lithopone

Mr. Marquand, in reply to a question by Mr. W. Shepherd, said it was unlikely that barytes would be available for export from Germany before the end of the year. Supplies for the U.K. would be imported by the Board of Trade on Government account. It was too early to say how distribution would be effected in this country. It was not possible to indicate at present when lithopone would be available for export from Belgium.

Export of Peat to U.S.A.

Major Lloyd asked the President of the Board of Trade whether he was aware that a large firm of exporters of Scottish granulated peat for fertilising purposes was unable to accept a U.S. order of at least 1,000,000 dollars because the suppliers of peat moss in Scotland were unable to obtain the necessary labour or secure permits to erect the special plant required.

Sir Stafford Cripps replied that his regional officers were in touch with the peat producers, who would be given all possible assistance to overcome their difficulties.

Linseed Oil and Glycerine

Mr. Bossom asked the President of the Board of Trade why, since he was experiencing the utmost difficulty in obtaining linseed oil and commercial glycerine, which were indispensable in the manufacture of paint, this country exported, in the first three months of this year, more than double

the amount exported in the corresponding period in 1938, and about seven times as much as was exported in the same period in 1945.

Sir Stafford Cripps replied that linseed oil exports this year had been extremely small in comparison with those in 1938. The exports of glycerine during the first three months of the year were mainly to fulfil a commitment to the U.S.A. entered into last November, when there were substantial stocks in the U.K. and there was no reason to suspect the shortage which had since developed.

Glue, Gelatine, Size

Answering Sir J. Mellor, Sir S. Cripps said that control of the supply and acquisition of glue, gelatine, and size had been re-imposed after consultation with the Trade Advisory Committee to ensure that available supplies, which are considerably less than the total demand, were distributed to the best advantage in the national interest. All practicable steps were being taken to increase supplies.

Plaster of Paris

Questioned by Capt. Baird, the Minister of Works, Mr. Wilson, stated that the output of all types of gypsum plaster was limited both by the supplies of gypsum and by manufacturing capacity, but steps were being taken to overcome these difficulties. Meanwhile manufacturers of plaster had been asked to give preference to dental and surgical requirements.

Penicillin

Mr. J. Lewis asked the Minister of Supply (1) the price at which penicillin was supplied by the manufacturers; (2) whether any price agreement existed between them; and (3) which firms were engaged in the manufacture of penicillin in this country, and the output of each concern for May and June.

Mr. Leonard: "Glaxo Laboratories, Ltd., operating commercially, and The Distillers Co., Ltd., operating a Government factory as agents for the Ministry of Supply, are the main producers of penicillin in this country. Production on a smaller scale is undertaken by Boots, I.C.I., and Kemball Bishop. The great bulk of the output of these concerns is purchased by the Ministry of Supply and it would be contrary to established practice to disclose details of the contracts. There is no price agreement among the manufacturers." In answer to a further question, Mr. Leonard said that there were no restrictions on firms not previously engaged in penicillin production, who now wished to produce it, apart from normal compliance with the Therapeutic Substances Act if the penicillin was to be used for injection.

DDT

Colonel Hutchison asked the Minister of Supply whether he was aware that the surplus Government stocks of insecticide known as DDT, widely advertised as being sold by chemists, had no wording on the package to show that they must be used with care and that several cases had recently been treated in hospital for maladies resulting from the use of this insecticide; and what steps he was taking to meet this situation.

Mr. Woodburn referred his questioner to the reply made by the Minister of Health to Mr. Austin on February 21 (see The Chemical Age, 1946, *54*, 211), and stated that the only sale of surplus Government stocks by the Ministry of Supply was in fact made to one of the original manufacturing firms.

Streptomycin

Mr. Brooks asked the Minister of Health what steps were being taken to import supplies of streptomycin from the U.S.A.; and what efforts were being made for its manufacture in this country.

Mr. Bevan: I am informed that American production of streptomycin is too small to permit export to this country. Arrangements are being made with the Ministry of Supply and the Medical Research Council to set on foot the manufacture in Great Britain of sufficient streptomycin for adequate clinical trials."

The Rutherford Unit

Measure of the Strength of Radioactive Sources

THE U.S. National Bureau of Standards advocates the name "rutherford" for a unit to designate the strength of radio active sources, in order to avoid the erroneous use for that purpose of the curie, which, by original definition, is "the amount of radon in equilibrium with one gram of radium." The quantity to be specified is the disintegration rate, determined by the decay constant and the number of atoms of the radioactive isotope in the source. This is simply a number, and to establish a unit the only requirement is to select a convenient number of disintegrations per second and to give it a name. A number which fits the requirement is 10^6. a small unit, of the order of magnitude of many sources used in laboratory measurements, and sufficiently different in size from the curie to obviate confusion. Any measuring device which will determine the total number of disintegrations per second will directly provide the strength of the source in rutherfords. The suggested abbreviation is rd., with such adaptations as krd., mrd., etc., to express multiples and submultiples.

Personal Notes

MR. T. WALTON has retired from the chairmanship of British Glues and Chemicals, Ltd., after 25 years in that capacity, but retains his seat on the board. He is succeeded by MR. R. DUNCALFE.

MR. J. A. CHADWICK, works foreman in the Bury chemical works of Arthur Ashworth, Ltd., who celebrated his 80th birthday recently, has been with the company more than 56 years.

The engagement is announced between MR. ROBERT H. S. ROBERTSON, son of Sir Robert Robertson, K.B.E., F.R.S., F.R.I.C., (lately Government chemist), and MISS ISOBEL S. MCNEILLY, of Lochwinnoch, Renfrewshire.

MR. E. H. MCCONNELL, manager in Northern Ireland of the interests of George Cohen, Sons & Co., Ltd., who has been awarded the M.B.E., played an important part in organising the export from Northern Ireland of scrap for use in the national war effort, and also organised the Red Cross Salvage Scheme in conjunction with the Ministry of Commerce for Northern Ireland.

MR. ROGER HEYWORTH, an executive of Unilever, Ltd., and youngest brother of the managing director, Mr. Geoffrey Heyworth, has been appointed a member of the U.K. Trade Mission which is due to leave for China next month. He will represent general merchanting interests. Another member is MR. A. H. CARMICHAEL, director of the British Non-Ferrous Metals Federation, who will represent light engineering interests.

MR. G. C. MANN and MR. J. A. E. HOWARD have been appointed directors of Howards & Sons, Ltd. Mr. Mann has been connected with the export side of the business since 1925 and will continue in his present position as commercial manager, with Mr. J. A. E. Howard as his assistant. The latter, who is the eldest son of Mr. Geoffrey Howard, chairman of the company, joined the firm early in 1938. Soon after the outbreak of war he joined the army and he was released last year after being a prisoner of war in Germany for nearly five years.

L.M.S. Chemists

The London, Midland and Scottish Railway has announced some staff changes in its scientific research department. MR. H. W. KEYS, F.R.I.C., divisional chemist at Derby, who entered the service of the old Midland Railway in 1903, retired on August 1, and has been succeeded by MR. S. BAIRSTOW, M.A., formerly divisional chemist at Stonebridge Park, who joined the service of the company in 1933. The new divisional chemist at Stonebridge Park is DR. G. H. WYATT, Ph.D., F.R.I.C., formerly assistant divisional chemist there, who entered the service of the company in 1935. MR. H. E. EKINS, who entered the service of the old Midland Railway in 1901 and has recently been assistant divisional chemist at Derby, retired on August 1.

Mineral Development

Committee of Inquiry Appointed

THE constitution of the committee of inquiry into the metalliferous and other mineral resources of this country, and their development, was announced this week by the Minister of Fuel. The committeee will have the title of Mineral Development Committee with the following terms of reference: "To inquire into the resources of minerals in the U.K., excepting coal, oil, bedded ironstone, and substances of widespread occurrence; to consider possibilities and means of their co-ordinated, orderly, and economic development in the national interest, and to make recommendations in regard thereto."

Lord Westwood is chairman of the committee and other members are: Mr. T. Balogh (Institute of Statistics, University of Oxford); Mr. A. R. Davies, A.M.Inst.-M.E. (T. C. Horabin & Partners, industrial consultants; Professor W. R. Jones, D.Sc., M.Inst.M.M. (Imperial College of Science and Technology, adviser to Board of Trade (China Clay), and chairman of China Clay Working Party); Mr. L. C. Hill, M.Inst.M.M., B.Sc. (technical adviser to Rio Tinto, Ltd.); Professor A. O. Rankine, O.B.E. (chief physicist, Anglo-Iranian Oil Co., Ltd.); Professor J. A. S. Ritson, M.Inst.M.M., B.Sc. (Professor of Mining, Royal School of Mines, and deputy chairman of Coal Commission); Mr. S. Robson, M.Inst.M.M. (Imperial Smelting Corporation, Ltd., and Foreign Secretary of the S.C.I.); Mr. T. Steele, M.P.; Capt. P. Thorneycroft, M.P.; and Mr. R. E. Yeabsley (Hill, Vellacott & Co., chartered accountants). The secretary is Mr. W. C. C. Rose, M.Sc., M.Inst.M.M., to whom all communications should be addressed at the Ministry of Fuel and Power, 40 Upper Brook Street, London, W.1.

Minute units of the radioactive isotope of carbon, Carbon-14, are reported by the New York correspondent of *The Times* to be the first peace-time product of the U.S. Government's atomic energy plants. They were produced in the same chain-reaction uranium ovens which produced the atomic bomb. This is the first fulfilment of the promised production of some hundreds of radioactive isotopes to be turned out at Oakridge.

General News—From Week to Week

"The War Effort of Sulzer Bros. (London) Ltd." is the title of a well-produced brochure which describes hitherto-unknown activities of that company and does them much credit.

The Minister of Food wishes to remind chemists that rape oil should not be sold by retail to the general public. Owing to the extreme shortage of this oil, it can only be issued for making up medicines.

The Minister of Town and Country Planning is stated to have given his approval to the use of the Wilton site as a general chemical factory by I.C.I., Ltd., subject to certain conditions.

All the oil refineries of the Anglo-Iranian Oil Co., Ltd., have survived the war in good condition, the chairman announced at the annual meeting last week, with the exception of that at Courchelettes, in France.

The address of the British Sulphate of Copper Association is now 1 Great Cumberland Place, London, W.1 (Telephone: PADdington 5068-9; telegrams: Britsulcop Phone, London).

Among bequests of the late Mr. R. J. Colman, director of J. & J. Colman, Ltd., who left £1,034,880 (net personalty £993,376), was one of £5000 to the directors of the company for the benefit of employees of the Carrow works.

The Minister of Food announces that there will be no change in the existing prices of unrefined oils and fats and technical animal fats allocated to primary wholesalers and large trade users during the four weeks ending August 31.

In accordance with the recommendation of the Royal Commission on Safety in Coal Mines, the Scotland Mines and Quarries Inspection Division is now divided into three Districts, each in charge of a District Inspector as follows: *East Scotland*: T. A. Rogers, 4 Eglinton Crescent, Edinburgh, 12; *West Scotland*: J. A. Grove, 170 Hope Street, Glasgow; *Ayrshire*: H. S. Stephenson, Nile Court, Ayr. Mr. A. H. Steele will continue as Divisional Inspector in general charge of the three districts.

Designed to make the best possible use of available supplies of linseed oil, a paint distribution scheme was introduced on August 1 by the Board of Trade, after full discussion with the paint industry. Under the scheme manufacturers must use their allocations of linseed oil in the manufacture of three classes of paint—building, transport, and general industrial—so that, in the aggregate, the Government can count on a known quantity of each class being available.

The research laboratories at Hammersmith of the Vitamins Group of Companies (Agricultural Food Products, Ltd., Bemax Sales, Ltd., and Vitamins, Ltd.) are being extended, as is their field station at Henley. In his speech at the annual meeting, the chairman of the Group, Mr. H. C. H. Graves, expressed confidence that the research department would maintain and advance the reputation of the Group's products.

Reed Brothers (Engineering) Ltd. announce that the equipping of their welding department at Albion Works, Alberta Street, Kennington, S.E.15, is now completed. They are accordingly in a position to undertake welding repairs, fabricating of machines, plant and structures to customers' requirements. Inquiries should be addressed to head office, Bevis Marks House, London, E.C.3. (Tel: AVEnue 1901/5).

Foreign News

The first post-war fair to be held in Prague will take place between September 15 and 22.

Nine industrial alcohol plants in the United States were closed up to the beginning of July last because of the lack of imported molasses.

Czechoslovakia is to export china clay and chemical products to Sweden, in return for iron ore, machinery, roller bearings and turpentine.

It is reported that a North American concern is to set up two factories in Brazil for the manufacture of dry ice, one at Rio de Janeiro and the other at S. Paulo.

The Kaiser Wilhelm Institute for Scientific Research, Berlin, has been dissolved by a decision of the occupying Powers. Certain of the laboratories will continue to function for peaceful ends.

A loss of 3,783,373 francs for 1945 is reported by the Belgian fertiliser company, Engrais et Produits Chimiques de la Meuse, making a total debit balance of 9,712,783 francs.

The conversion of a kiln for the exclusive production of chemical-grade bauxite at Paranam, Dutch Guiana, has been delayed by the non-arrival of the necessary structural steel, but it is expected to be in operation by next month.

Limited commercial distribution (through hospitals) of streptomycin in the U.S.A. was due to begin on August 1, according to a statement of the Civilian Production Administration, the same plan being followed as with the initial distribution of penicillin. Production of streptomycin in April was 36,982 gm., against 26,840 gm. in March.

A tantalite deposit, described as "one of the richest and largest in the world," has recently been discovered east of Yellowknife, Mackenzie, in the Canadian North-West. It is reported that a company financed by Canadian and United States miners is planning to exploit the occurrence.

Under a five-year plan, the industrialisation of Estonia is to be promoted at a rate of expenditure of 3500 million roubles. Tallinn, the capital, is to become the centre of the engineering industry, and the output of the shale oil industry is to be increased from the pre-war level of about 500,000 tons to 8,400,000 tons in 1950.

According to a note in *L'Industrie Chimique* (July, 1946) the reopening of the mines of Les Malines (Gard), once prosperous, but closed since 1932, are about to be reopened by the Société Minière de Peñarroya. The ore—calamine and blende—was previously worked for its zinc, lead, and silver content; it now appears that the 3 per cent. cadmium content is also to be exploited.

The well-known French chemical concern of Saint-Gobain reports substantial progress during 1945. At the beginning of the year only one lead chamber and four anhydrite plants were in operation. Import of pyrites and phosphate rock restarted in the summer, and by the end of December 14 lead chambers and 15 anhydrite plants were working. Production of phosphatic fertilisers rose from 1900 tons in March to 17,800 tons in December. A summary of the report is published in *L'Industrie Chimique* (July, 1946, p. 130).

New Companies Registered

Multipro, Ltd. (414,051).—Private company. Capital, £250 in £1 shares. Manufacturers of, agents for and dealers in chemicals, etc. Subscribers: W. J. Bates; J. Bates. Registered office: 71 Moorgate, E.C.2.

Gatford, Ltd. (414,190).—Private company. Capital, £100 in £1 shares. Manufacturers of and/or dealers in chemicals, pigments, dyestuffs, oils, soaps, etc. Directors: G. Thompson; B. R. Fisher. Registered office: 15 Eynsford Rise, Eynsford, Kent.

Othmer Mellenger, Ltd. (414,483).—Private company. Capital, £1000 in £1 shares. Manufacturers of and dealers in plastics, chemicals, paints, etc. Directors: E. R. Mellenger; D. Boyd; D. C. Cann. Registered office: Eldon Street House, Eldon Street, E.C.2.

Stewart Brothers (London), Ltd. (415,707).—Private company. Capital £5000 in £1 shares. Chemical, mechanical and electrical engineers, etc. Directors: J. H. Stewart, W. T. Stewart. Registered office: Offices of Graham Smart & Annan, 109 Jermyn Street, S.W.1.

Sterling Products Co. (Lancashire), Ltd. (413,924).—Private company. Capital, £4000 in £1 shares. Manufacturers and/or vendors of artificial and chemical manures and fertilisers, etc. Directors: H. Blackburn; R. Parr. Registered office: Sidings Road, Fleetwood, Lancs.

A. E. Seargeant & Co., Ltd. (413,838).—Private company. Capital, £500 in £1 shares. Manufacturers of and dealers in chemicals, gases, drugs, plastics, disinfectants, etc. Directors: A. E. H. I. Seargeant; Mrs. D. M. I. Seargeant, 8 Oxford Gardens, Winchmore Hill, N.21.

United Laboratories, Ltd. (413,419).—Private company. Capital, £2000 in £1 shares. Wholesale and retail chemists and druggists, laboratory proprietors, etc. Subscribers: J. A. Steemson; W. M. Isaacs. Registered office: Mount Pleasant, Alperton, Wembley, Middlesex.

Murray-Martin, Ltd. (413,406).—Private company. Capital, £2000 in £1 shares. Consulting, analytical, manufacturing and general chemists, etc. Directors: J. Murray; Mrs. D. Murray; T. P. Martin; M. Martin. Registered office: 372 Cowbridge Road, Cardiff.

Southern Plastics, Ltd. (416,193).—Private company. Capital £2000 in £1 shares. Manufacturers of and dealers in all organic and inorganic chemical substances and products, natural or synthetic plastics and plastic substances, etc. Directors: F. W. S. Searles; J. M. Houston; R. L. Porter; H. G. Porter. Registered office: Albert Ironworks, Green Street Green Road, Darford, Kent.

Company News

British Colloids, Ltd., Gorst Road, Park Royal, London, N.W.10, has changed its name to Crookes Laboratories, Ltd.

Thawpit (Proprietary) Ltd., Woodstock Grove, W.12, has changed its name to Thawpit, Ltd.

Sangers, Ltd., report a net profit, for the year ended March 31, of £266,036 (£224,590 for 11 months). A final ordinary dividend of 15 per cent. has been declared, plus 5 per cent. bonus, making 30 per cent. for the year (25 per cent. for 11 months).

An increase in net profit from £99,047 to £140,939 is reported by **Fison's, Ltd.,** for the year ended September 30, 1945. The ordinary dividend was maintained at 10 per cent. A final dividend of 7½ per cent. on the ordinary shares, together with interim dividend of 2½ per cent. in respect of the current year, is payable on August 23.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

ANODISING & PLATINGS, LTD., London, S.W. (M., 10/8/46.) July 10, mortgage and charge, to Midland Bank, Ltd., securing all moneys due or to become due to the Bank; charged on Tower Works, Holland Street, Radcliffe, together with machinery, fixtures, etc., also general charge. *£2500. December 25, 1945.

BRAMSON & BLADES, LTD., London, E.C., aluminium manufacturers. (M.10/8/46.) July 12, debenture, to Lloyds Bank, Ltd., securing all moneys due or to become due to the Bank; general charge (subject to, etc.).

Satisfactions

METAL SALTS, LTD., Chester. (M.S., 10/8/46.) Satisfaction July 18, of mortgage registered March 8, 1943.

NORTH-BRITISH CHEMICAL CO., LTD., Manchester. (M.S., 10/8/46.) Satisfaction July 18, of debentures registered September 16, 1933, to the extent of £2700.

Chemical and Allied Stocks and Shares

HOLIDAY influences prevented improvement in the volume of Stock Exchange business, although generally firmer conditions developed under the lead of a sharp advance in colliery shares, which reflected hopeful assumptions as to compensation based on the industry's global award in respect of nationalisation. Gains in colliery shares ranged up to 8s., while iron and steel shares were better and generally there was a firmer tendency in the nationalisation groups, including home rails. Leading industrials rallied, and in some directions were higher on balance, while oil shares were more active on the Government's efforts to encourage the use of fuel oil in place of coal.

Imperial Chemical, after their recent decline to 42s. 6d., have rallied well to 43s. 9d. Moreover, United Molasses at 53s. 7½d., Turner & Newall 89s. 9d., and Dunlop Rubber at 72s. 3d. have responded to moderate improvement in demand. There was buying of the units of the Distillers Co., which rose to 139s. 3d. Associated Cement moved up to 70s. 6d., and British Plaster Board were better at 34s. 6d. Triplex Glass 10s. ordinary attracted more attention and improved to 42s. 6d. on revived talk of an increased dividend for the financial year ended June 30, although this is not generally expected. Amalgamated Metal shares eased to 20s. 7½d., Borax Consolidated held firm at 46s. 3d., the pending debenture conversion operation opening up the prospect of a higher dividend on the ordinary shares, according to some views. British Glues eased to 15s. 4½d., but Goodlass Wall at 30s. 1½d. regained part of an earlier decline. Levers weakened to 52s. 6d., but later were inclined to rally in accordance with the better trend of markets. Fisons were 61s. 9d. Johnson Matthey have changed hands at slightly over 70s., while B. Laporte remained at 100s. Burt Boulton marked 26s. 3d., and W. J. Bush 89s. 4½d. Greeff-Chemicals 5s. ordinary were around 13s. Monsanto Chemicals 5½ per cent. preference were 23s., and Leeds Fireclay preference 17s. 6d. A sharp rise to 21s. 3d. in Splintex Glass preference shares was attributed to homes of improved financial results or of a scheme to fund dividend arrears.

Among sharp gains in colliery shares, Staveley jumped 3s. to 49s. 9d. Shipley were up 2s. at 36s. 6d., while Bolsover at 59s. were prominent, having risen 8s. 6d. Powell Duffryn showed firmness at 24s. Iron and steel shares were also better, United Steel being 24s. 9d., Dorman Long 25s. 3d., and Stewarts & Lloyds 48s. 9d., while Tube Investments improved to £5 13/16. Thomas & Baldwins remained under the influence of the higher profits for the past year, but Hadfields reacted to 25s. on disappointment with the reduced interim payment. Elsewhere, Allied Ironfounders improved to 55s. 9d.

Boots Drug at 63s. 3d. regained part of an earlier decline, as did Beechams deferred at 26s., while Sangers strengthened to 34s. 6d. immediately following the news of the increased payment. Electric equipment shares were lower on balance, General Electric being 98s. 9d. English Electric 60s. with the new preference shares at 1s. 4½d. premium. De La Rue were lower at £12⅞. Fine Spinners firmed up to 24s. Among textiles, Bradford Dyers were 24s. 3d., Calico Printers 23s. 6d., and Bleachers 14s. 3d. Courtaulds rallied to 56s. 7½d., and British Celanese were 35s. 6d.

Babcock & Wilcox were 63s. 6d., and Ruston & Hornsby rose 2s. 6d. to 61s. 3d. on the Government's efforts to secure increased use of fuel oil. Leading oil shares were slightly higher, although Anglo-Iranian eased to 99s. 4½d. on the latest news from Persia.

Prices of British Chemical Products

THERE has been little alteration in the general position on the London chemical market and in most sections supplies are taken care of for some time to come. Contract deliveries, apart from the annual holiday interruption, are up to schedule, and the flow of export orders shows no sign of falling off. Values throughout the industrial chemical market are fully maintained and the undertone is strong. There have been no special features in the coal-tar products market, where the volume of business depends mainly on the availability of supplies. Quotations are very firm.

MANCHESTER.—The Manchester market for both light and heavy chemicals during the week has been decidedly under the influence of the holidays and fresh buying on home trade account has been noticeably affected. There have also been fewer inquiries in evidence from shippers, though export buying interest is expected to stage an early recovery. On the whole, however, apart from those consuming works directly affected by the holidays, contract deliveries of the soda products and most other chemicals, including the mineral acids, have been on a fair scale, and this also applies to the leading coal-tar products.

GLASGOW.—The improved demand for general chemicals for the home trade has been maintained, and the short supply of some products has meant that all demands could not be met. Prices continued at round about previous levels. The export market has again been busy.

Price Changes

Rises: Ammonium bicarbonate (Manchester); calcium acetate; copper carbonate (Manchester); lead nitrate (London and Manchester); lithopone; oxalic acid (London and Manchester); sodium sulphide; sulphur.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton, £47 10s.; 80% pure, 1 ton, £49 10s.; commercial glacial, 1 ton, £59; delivered buyers' premises in returnable barrels, £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r. MANCHESTER: £16 to £16 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER: £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—MANCHESTER: £40 per ton d/d.

Ammonium Carbonate.—£37 10s. to £38 per ton d/d in 5 cwt. casks. MANCHESTER: Powder, £43 d/d.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £19 10s. per ton. See also Salammoniac.

Ammonium Persulphate.—MANCHESTER: £5 per cwt. d/d.

Antimony Oxide.—£110 to £117 per ton.

Arsenic.—Per ton, 99/100%, £26 10s. for 20-ton lots, £31 for 2 to 10-ton lots; 98/99%, £25 for 20-ton lots, £29 10s. for 2 to 10-ton lots; 96/99% white, £21 15s. for 20-ton lots, £25 15s. for 2 to 10-ton lots.

Barium Carbonate.—Precip., 4-ton lots, £19 per ton d/d; 2-ton lots, £19 5s. per ton. bag packing, ex works.

Barium Chloride.—98/100% prime white crystals, 4-ton lots, £19 10s. per ton, bag packing, ex works.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £18 15s. per ton d/d; 2-ton lots, £19 10s. per ton.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax.—Per ton for ton lots, in free 1-cwt. bags, carriage paid: Commercial, granulated, £30; crystals, £31; powdered, £31 10s.; extra fine powder, £32 10s. B.P., crystals, £39; powdered, £39 10s.; extra fine, £40 10s. Borax glass, per ton in free 1-cwt. waterproof paper-lined bags, for home trade only, carriage paid: lump, £77; powdered, £78.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial,

granulated, £52; crystals, £53; powdered, £54; extra fine powder, £56. B.P., crystals, £61; powder, £62; extra fine, £64.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£22 to £24 per ton, ex wharf. Granulated, supplies scarce.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5⅝d. per lb.

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Carbonate.—MANCHESTER: £8 15s. per cwt. d/d.

Copper Oxide.—Black, powdered, about 1s. 4½d. per lb.

Copper Sulphate.—£33 10s. per ton, f.o.b., less 2%, in 2 cwt. bags.

Cream of Tartar.—100 per cent., per cwt., from £13 17s. 6d. for 10-cwt. lots to £14 1s. per cwt. lots, d/d. Less than 1 cwt., 2s. 5½d. to 2s. 7½d. per lb. d/d.

Formaldehyde.—£27 to £28 10s. per ton in casks, according to quantity, d/d. MANCHESTER: £28.

Formic Acid.—85%, £54 per ton for ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1260 s.g., in tins, £4 to £5 per cwt., according to quantity; in drums, £3 19s. 6d. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—11d. per lb. d/d, carboys extra and returnable.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d per lb., according to quantity.

Lactic Acid.—Pale tech., £60 per ton; dark tech., £53 per ton ex works; barrels returnable.

Lead Acetate.—White, 57s. to 60s. per cwt., according to quantity.

Lead Nitrate.—About £55 per ton d/d in casks. MANCHESTER: £55.

Lead, Red.—Basic prices per ton: Genuine dry red lead, £71; orange lead, £83. Ground in oil: Red, £84; orange, £95. Ready-mixed lead paint: Red, £86; orange, £98.

Lead, White.—Dry English, in 8-cwt. casks, £83 per ton. Ground in oil, English, in 5-cwt. casks, £94 10s. per ton.

Litharge.—£57 10s. to £60 per ton, according to quantity.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £36 per ton.

Magnesium Chloride—Solid (ex wharf), £22 per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., for 2-cwt lots, 9s. 1d.; smaller quantities dearer.

Mercurous Chloride.—10s. 1d. to 10s. 7d. per lb., according to quantity.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 3s. per gal.; pyridinised 64° O.P. 100 gal., 3s. 1d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£100 to £101 per ton in ton lots packed in free 5-cwt. casks. MANCHESTER: £5 per cwt.

Paraffin Wax.—Nominal.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £76 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate. — Crystals and granular, 7⅞d. per lb.; ground, 8⅞d. per lb., for not less than 6 cwt.; 1-cwt. lots, ¼d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £57 per ton for 5-ton lots, £57 10s. per ton for 1 to 5-ton lots, all ex store; hydrated, £51 per ton for 5-ton lots, £51 10s. for 1 to 5-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 8½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8d. per lb.; technical, £7 14s. 3d. to £8 6s. 3d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Salicylic Acid.—MANCHESTER: 1s. 8d. to 2s. 1d. per lb. d/d.

Soda, Caustic. — Solid 76/77%; spot, £16 7s. 6d. per ton d/d.

Sodium Acetate.—£42 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 6½d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite. — Powder, 60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£36 to £45 per ton, nominal.

Sodium Hyposulphite.—Pea crystals 19s. per cwt. (ton lots); commercial, 1-ton lots, £17 per ton carriage paid. Packing free.

Sodium Iodide.—B.P., for not less than 28 lb., 9s. 11d. per lb., for not less than 7 lb., 13s. 1d. per lb.

Sodium Metaphosphate (Calgon).—11d. per lb. d/d.

Sodium Metasilicate.—£16 10s. per ton, d/d U.K. in ton lots.

Sodium Nitrite.—£22 10s. per ton.

Sodium Percarbonate.—12½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £25 per ton d/d for ton lots. Tri-sodium, £27 10s. per ton d/d for ton lots (crystalline).

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salt).—£4 10s. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. MANCHESTER: £4 12s. 6d. to £4 15s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot, £20 2s. 6d. per ton, d/d, in drums; crystals, 30/32%, £13 7s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £14 5s. to £16 10s., according to fineness.

Sulphuric Acid.—168° Tw., £6 2s. 8d. to £7 2s. 8d. per ton; 140° Tw., arsenic-free, £4 11s. per ton; 140° Tw., arsenious, £4 3s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—Per cwt., for 10 cwt. or more, £15 8s.; 5 to 10 cwt., £15 9s. 6d.; 2 to 5 cwt., £15 11s.; 1 to 2 cwt., £15 13s. Less than 1 cwt., 8s. 1d. to 8s. 3d. per lb. d/d, according to quantity.

Tin Oxide.—Nominal.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d; white seal, £54 5s.; green seal, £53 5s.; red seal, £51 15s.

Zinc Sulphate.—Tech., £25 per ton, carriage paid.

Rubber Chemicals

Antimony Sulphide.—Golden, 1s. 5d. to 2s. 6d. per lb. Crimson, 2s. 2d. to 2s. 6d. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 3s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£37 to £41 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£44 to £49 per ton, according to quantity.

Chromium Oxide.—Green, 2s ped lb.

India-rubber Substitutes.—White, 6 3/16d. to 10½d. per lb.; dark, 6 3/16d. to 6 15/16d. per lb.

Lithopone.—30%, £28 2s. 6d. per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Plus 5% War Charge.

Nitrogen Fertilisers

Ammonium Phosphate.—Imported material, 11% nitrogen, 48% phosphoric acid, per ton in 6-ton lots, d/d farmer's nearest station, in August, £19 12s., rising by 5s. per ton per month to September, then by 2s. 6d. per ton per month to March, 1947.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, in August, £9 12s. 6d., rising by 1s. 6d. per ton per month to March, 1947.

Calcium Cyanamide.—Nominal; supplies very scanty.

Concentrated Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. No. 1 grade, where available, £14 18s. 6d.

"Nitro Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £17 5s. per ton; granulated, over 98%, £16 per ton.

Coal Tar Products

Benzol.—Per gal. ex works: 90's, 2s. 6d.; pure, 2s. 8½d.; nitration grade, 2s. 10½d.

Carbolic Acid.—Crystals, 11½d. per lb. Crude, 60's, 4s. 3d. MANCHESTER: Crystals, 9½d. to 11½d. per lb., d/d; crude, 4s. 3d., naked, at works.

Creosote.—Home trade, 5⅞d. to 8d. per gal., according to quality, f.o.r. maker's works. MANCHESTER, 6½d. to 9¾d. per gal.

Cresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. MANCHESTER: Pale, 99/100%, 4s. 4d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £7 2s. 6d. to £10 per ton, according to m.p.; hot-pressed, £11 10s. to £12 10s. per ton, in bulk ex works; purified crystals, £25 15s. to £28 15s. per ton. Controlled prices.

Pitch.—Medium, soft, home trade, 75s. per ton f.o.r. suppliers' works; export trade, 120s. per ton f.o.b. suppliers' port. MANCHESTER: 75s. to 77s. 6d. f.o.r.

Pyridine.—90/140°, 18s. per gal.; 90/160°, 14s. MANCHESTER: 14s. 6d. to 18s. 6d. per gal.

Toluol.—Pure, 3s. 1d. per gal.; 90's, 2s. 4d. per gal. MANCHESTER: Pure, 3s. 1d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 3½d. to 3s. 6d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £21 per ton; grey, £25. MANCHESTER: Grey, £25 per ton.

Methyl Acetone.—40/50%, £56 per ton.

Wood Creosote.—Unrefined, about 2s. per gal., according to boiling range.

Wood Naphtha, Miscible.—4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. per gal.

Wood Tar.—£5 per ton.

Intermediates and Dyes (Prices Nominal)

***m*-Cresol 98/100%.**—Nominal.

***o*-Cresol 30/31° C.**—Nominal.

***p*-Cresol 34/35° C.**—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb; 66/68° C., 1s.

***p*-Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

***o*-Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

***p*-Toluidine.**—2s. 2d. per lb., in casks.

***m*-Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON.—August 7.—For the period ending August 31 (August 17 for refined oils), per ton, naked, ex mill, works or refinery, and subject to additional charges according to package: LINSEED OIL, crude, £65. RAPESEED OIL, crude, £91. COTTONSEED OIL, crude, £52 2s. 6d.; washed, £55 5s.; refined edible, £57; refined deodorised, £58. COCONUT OIL, crude, £49; refined deodorised £56; refined hardened deodorised, £60. PALM KERNEL OIL, crude, £48 10s.; refined deodorised, £56; refined hardened deodorised, £60. PALM OIL (per ton c.i.f.), in returnable casks, £42 5s.; in drums on loan, £41 15s.; in bulk £40 15s. GROUNDNUT OIL, crude, £56 10s.; refined deodorised, £58; refined hardened deodorised, £62. WHALE OIL, crude hardened, 42 deg., £84; refined hardened, 46/48 deg., £85. ACID OILS: Groundnut, £40; soya, £38; coconut and palm-kernel, £43 10s. ROSIN: Wood, 32s. to 45s.; gum, 44s. to 54s. per cwt., ex store, according to grade. TURPENTINE, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Liquid-flow control.—T. M. Fraser, J. H. Carter, and I.C.I., Ltd. 20397.

Sulphonamides.—General Aniline & Film Corporation. 19806-8.

Dyestuffs.—Gevaert Photo-Producten N. V. 19788.

Silver halide emulsions.—Gevaert Photo-Producten N.V., P. F. F. de Smet, and A. E. van Dormall. 20149.

Cholesteral.—Glaxo Laboratories, Ltd., A. E. Bide, and P. A. Wilkinson. 20176-7.

Insecticides.—J. R. U. Hatton. 20084.

Fertilisers.—G. E. Heyl. 19876.

Trichlorethanes.—R. M. Hughes (J. R. Geigy A.-G.). 19953-4.

Dyestuffs.—J. D. Kendall, F. P. Doyle, and Ilford, Ltd. 19762.

Esters.—Lever Bros. & Unilever, Ltd. 20367.

Borates.—E. M. Meade, and Lankro Chemicals, Ltd. 19844.

Ricinoleic compounds.—E. M. Mead, and Lankro Chemicals, Ltd. 19845, 19847.

Chemical compounds.—Merck & Co., Inc. 19727.

Calcium lead alloys.—National Smelting Co., Ltd., and L. J. Derham. 19735.

Alloys.—Purdue Research Foundation. 19884.

Thermosetting resin.—Quaker Oats Co. 19878-9.

Alloys.—Soc. Le Carbone-Lorraine. 19889.

Carbides.—Soc. Le Carbone-Lorraine, 19890.

Treatment of aluminium.—A. H. Stevens (Aluminium Co., of America). 19760.

Artificial resins.—A. H. Stevens (Quaker Oats Co.). 19761.

Detergents.—Sylvania Industrial Corporation. 19862.

Electro deposition of metals.—Udylite Corporation. 19681-2.

Hydrocarbons.—Universal Oil Products Co. 19722.

Thiazole derivatives.—Ward Blenkinsop & Co., Ltd., A. A. Goldberg and W. Kelly. 20031.

Amino-alcohols.—Abril Corp. (Great Britain), Ltd., C. D. Moore, and N. Longley. 20697.

Heat exchangers.—Aluminium Plant & Vessel Co., Ltd., R. Seligman, H. F. Goodman, and G. H. Botham. 20744.

Resinous material.—American Cyanamid Co. 20597.

Esters.—American Cyanamid Co. 20752-3, 20757.

Insecticides.—American Cyanamid Co. 20893.

Deposition of metallic films.—Andre Rubber Co., Ltd., and S. Buchan. 20771.

Drying ceramic ware.—Apex Construction, Ltd., G. C. A. Peck, and W. C. Peck. 20965.

Hydrocarbons.—J. C. Arnold (Standard Oil Development Co.). 20533.

Polycarbamates.—W. Baird, P. Gaubert, A. Lowe, and I.C.I., Ltd. 20879.

Protein-containing compositions. — L. Berger & Sons, Ltd., H. J. Tattersall, and L. E. Wakeford. 20991.

Condensation products.—L. Berger & Sons, Ltd., H. J. Tattersall, and L. E. Wakeford. 20992.

Polyureas.—L. Bradford, W. Charlton, H. Plimmer. E .B. Robinson, and I.C.I., Ltd. 20464.

Condensation products.—L. Bradford, W. Charlton, E. B. Robinson, C. D. Weston, and I.C.I., Ltd. 20463.

Organic compounds.—J. G. M. Bremner, R. K. F. Keeys, and I.C.I., Ltd. 20568.

Complete Specifications Open to Public Inspection

Recovery of oils from fat animal matter. —A/B Separator. January 11, 1945. 34746/45.

Production of metals and metal alloys.—A/S Smeltemetoden. January 13, 1945. 1087/46.

Cyanuric chloride.—American Cyanamid Co. January 16, 1945. 21564/45.

Continuous process of isolating substantially anhydrous pyridine bases from aqueous mixtures.—American Cyanamid Co. January 16, 1945. 35229/45.

Silica gels.—American Cyanamid Co. January 16, 1945. 1352/46.

Heating liquid baths.—M. Boss. November 19, 1938. 18125/46.

Allyl alcohol.—Carbide & Carbon Chemicals Corp. January 16, 1945. 28809/45.

Treatment of hydrophilous cellulose textiles.—Comptoir des Textiles Artificiels. April 21, 1944. 17988/46.

Vacuum distillation process and apparatus.—Distillation Products Inc. January 10, 1945. 437/46.

Solid and semi-solid polymers of olefinic hydrocarbons.—E. I. du Pont de Nemours & Co. December 19, 1942. 21178/43.

Sensitising photographic silver halide emulsions.—N.V. Gevaert Photo-Producten. May 22, 1941. 17596/46.

Pulverising of difficultly frangible materials.—International Pulverising Corp. June 17, 1942. 17790/46.

Alkyl silicon halides.—Dow Chemical Co. January 15, 1945. 960/46.

Formaldehyde.—E. I. du Pont de Nemours & Co. January 11, 1945. 1016/46.

Anti-freeze compositions.—Lonza Electric & Chemical Works, Ltd. January 10, 1945. 787/46.

Sterilisation and preservation of comestible materials.—Mathieson Alkali Works. January 11, 1945. 27058/45.

Manufacturing iodated proteins and cattle food containing the same.—N.V.Mij. tot Exploitatie der Oliefabrieken Calve-Delft. July 9, 1943. 17986/46.

Immersion cells for conductivity measurements of liquids.—N.V. Philips Gloeilampenfabrieken. April 16, 1942. 18035/46.

Manufacture and application of cold-swelling starches.—N.V. W. A. Scholten's Chemische Fabrieken. October 22, 1943. 17604/46.

Electro-recovery of metals.—National Lead Co. January 13, 1945. 29039/45.

Protection of substances or mixtures against oxidative alterations.—J. E. Nyrop. January 15, 1945. 298/46.

Fluorescent materials.—Philips Lamps, Ltd. January 2, 1945. 11/46.

Complete Specifications Accepted

Recovery of glycerine from fermented liquors.—R. A. Walmesley, and I.C.I., Ltd. July 16, 1940. (Addition to 515,831.) 578,259.

Recovery of glycerol from fermented liquors.—R. A. Walmesley, and I.C.I., Ltd. Sept. 18, 1940. (Cognate applications 14328/40 and 18242/40.) 578,260.

Treatment of polysulphide resins.—L. A. Jordan, J. K. Aiken, and G. L. Holbrow. April 16, 1943. 578,656.

Manufacture of organic monosulphides.—W. A. Robshaw and Monsanto Chemicals, Ltd. May 9, 1944. 578,684.

Process for the preparation of metallisable polyazo dyestuffs.—Sandoz, Ltd. July 2, 1943. 578,537.

Preparation of penicillin salts.—Schering Corporation. Jan. 6, 1942. 578,590.

Densifying finely divided materials.—Shawinigan Chemicals, Ltd. June 4, 1943. 578,658.

Controlled oxidation of aralkyl hydrocarbons and of their partially halogenated derivatives.—Shell Development Co. 578,608.

Preparation of amino alcohols.—Shell Development Co. Feb. 13, 1943. 578,635.

Manufacture of esters of phosphoric acid.—Soc. of Chemical Industry in Basle. July 21, 1941. 578,551.

Apparatus for drying fertilisers and like materials.—G. M. Tyler. April 19, 1943. 578,518.

Synthesis of 4-hydroxy-coumarins.—Wisconsin Alumni Research Foundation. Aug. 29, 1942. 578,589.

Methods of concentrating ores.—American Cyanamid Co. March 31, 1942. 578,694-5.

Production of producer gas.—M. H. M. Arnold, D. R. Pryde, R. J. Morley, and I.C.I., Ltd. June 2, 1944. 578,711.

Anti-friction bearings having fluid passages.—R. C. Braithwaite, and Metropolitan-Vickers Electrical Co., Ltd. May 28, 1940. 578,734.

Apparatus for producing aerosols.—British Thomson-Houston Co., Ltd. March 24, 1943. 578,783.

Cyclopentadiene addition products.—P. G. Carter, H. Plimmer, and I.C.I., Ltd. September 7, 1944. 578,867.

Process for the production of alkyl esters from fats and fatty oils.—Colgate-Palmolive-Peet Company. October 17, 1942. 578,751.

Polymerisation process.—Distillers Co., Ltd., J. J. P. Staudinger, and D. A. Bennett. September 6, 1943. 578,849.

Manufacture of polymeric materials from butadiene or its homologues.—E. G. Edwards, D. B. Kelly, W. M. Morgan, and I.C.I., Ltd. February 15, 1943. 578,846.

Method of connecting metal parts by brazing.—Engineering & Research Corporation. February 17, 1943. 578,705.

Fluid-solid contact-surfaces.—A. A. Griffith. August 25, 1942. 578,763.

Interpolymerisation of vinyl acetate and methyl methacrylate.—Imperial Chemical Industries, Ltd. September 18, 1941. 587,767.

Drowning of nitrocellulose and apparatus for use therein.—J. D. Pearson, D. G. Ashcroft, and I.C.I., Ltd. (Cognate applications 15793/41 and 380/43.) December 8, 1941. 578,691.

Detection of carbon monoxide in admixture with other gases.—E. W. Russell. August 25, 1942. 578,745.

Liquid containers and the manufacture thereof.—L. Shakesby, and I.C.I., Ltd. March 27, 1944. 578,706.

Flexible containers for liquids.—L. Shakesby, S. H. Smith, and I.C.I., Ltd. February 25, 1944. 578,855.

Heat-exchange apparatus.—G. R. Shepherd (Westinghouse Electric International Co.). January 17, 1944. 578,804.

Manufacture of lubricants.—Standard Oil Development Co. April 17, 1941. 578,692, 578,723-25.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Telegrams: ALLANGAS FLEET LONDON — Telephone: CENTRAL 3212 (12 lines)

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1416. — August 17, 1946 — Annual Subscription 21s. Overseas 26s.

Fuel Oil

THE decision of the Chancellor of the Exchequer, prompted undoubtedly by the Minister of Fuel and Power, to bring to an end the tax on fuel oil, as recorded in our columns last week (p. 175), closes at least temporarily a chapter of rather unseemly wrangling between two great industries. So long as coal was cheap, competition from fuel oil was inappreciable. But as the oil industry developed, and the coal industry deteriorated during and after the 1914-18 war, the position changed. The coal industry found itself losing ground. The entry into industry of the profession of fuel technologist—an entry now happily consolidated by the recent grant of a Royal Charter to the Institute of Fuel—soon caused great firms who had been prodigal in their expenditure of coal to look towards fuel efficiency to reduce their working costs. This, coupled with a trade depression, made the colliery companies anxious about output. Unemployment became rife in the coalfields; profits dwindled and ultimately vanished. In these circumstances the Coal Utilisation Council was born. One of its chief objectives appeared to the unprejudiced observer to be the elimination of oil fuel from this country. Every possible means, including political action, was taken to this end. The result of the agitation by the coal industry before and after the formation of the C.U.C. was that the Government of the day established in 1933 a tax of a penny a gallon on all imported oil.

With the aid of this tax, the coal industry effectively met the competition of oil. The consumption of oil for fuel purposes, which had been rising steadily before that date, remained fairly stationary with, if anything, a tendency to decline. The reason for this was not only the tax as levied; it was the fear that the tax might be further increased. The present removal of the tax is a direct change of attitude on the part of the Government and the coal industry. With the nationalisation of the coal industry, the old fires of competition have died. The Minister has also to face the fact that unemployment has ceased in the coalfields, and that on the contrary there is grave doubt, as we have pointed out previously in these columns, whether we shall get through the next two winters without serious dislocation of industry due to coal shortage. Consequently, the Minister of Fuel and Power has looked round for another source of fuel, and has decided to introduce oil fuel in quantities as large as he can succeed in using.

The change-over can be made in two ways. There will be a certain

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number of coal-burning appliances that can change readily to fuel oil by replacement of the grates by oil-burning equipment. These will be the first objective, and here the replacement will involve no serious issues. Long-term replacement, however, is quite another matter. There are many furnaces and plants which cannot be changed from solid fuel to oil without complete rebuilding. Once a change is made, it is final over the length of life of the plant. Industry will naturally ask whether the removal of the oil tax is permanent, but to that there is at present no answer. The official announcement says that the removal of the tax will afford an appreciable relief against the higher operating costs of oil-burning plant compared with coal-burning plant and the Chancellor of the Exchequer hopes it will result in conversions from coal to oil to the maximum extent possible. Unless relief from the oil tax is promised for a stated period of years, it is unlikely that any major conversions will be made.

This problem demands handling in a new way. Fuel oil experts who know what is being done abroad declare that the use of oil has various advantages for industry. These advantages are, it is said, secured by the foreign manufacturer because he has access to unlimited oil and at a price much below ours. Among other things it is stated that steel in America is generally made, even in the coal areas, by the use of oil fuel in the open-hearth furnaces. The output of the furnaces is said to be increased and the quality of the steel improved. Increase in furnace output is an important step towards reduction in costs. The effect of cheaper steel in the competitive power of America and Britain in the export trade may well be serious. Thus, if the contentions of the oil industry are sound, the imposition of a tax on fuel oil may well handicap this country in the markets of the world. We are all in favour of free competition, and though competition is foreign to nationalisation, this move may well bring free competition into the fuel industries. There are many who believe that coal will hold its own through the use of town gas, which possesses the advantages of oil by comparison with coal in superabundant measure, but is likely to be dearer in initial price per therm delivered. The gas industry believes that the competition of oil can be met. But let us have competition. Let our nationalised industries face competition, for it is only in that way that they can hope to be kept alive at all.

The total quantity of oil fuel that is likely to be used in this country is not very great. The amount used for all burning and processing purposes at present is of the order of 1½ million tons a year, excluding shipping and Admiralty requirements. We doubt whether an additional million tons will be used this coming winter. We should not expect more than about 3,000,000 tons to be used at any time, though more optimistic statements have been known to be made. When oil and coal find their own level, it will be interesting to see where that level is, but it will be doubly interesting to discover whether the use of tax-free oil reduces the cost of manufacture of any goods to a significant extent.

The way in which the oil tax has been removed and the appeals to use oil for any and every purpose suggest that the Minister of Fuel and Power and the Government have become more than a little panic-stricken before the coal situation in the approaching winter—as well they might. But the problem needs to be considered on a long-term basis. It demands collaboration between the oil industry and the coal industry. That may seem to many to be asking for the moon; but have we not reached a stage at which these things are not only necessary but possible? Whence comes our oil? What do we have to pay for it abroad? Clearly some payment must be made outside the country even if it all comes from oilfields and refineries that we ourselves own through the Anglo-Iranian Oil Company and similar bodies. Commonsense suggests that we should use such oil only for those purposes for which it is really well suited. It would be foolish, for example, to import oil for use in central heating; it might be very desirable to import oil for use in the open-hearth steel furnace. We hope that some reasonable planned programme of fuel-oil utilisation will be adopted.

It will occur to many that the removal of the oil tax will bring nearer the home refining of oil. Care should be taken in adopting this view for the present. There are many difficulties in the way of home refining. Not the least is the uncertainty of the period for which the tax is to be removed. Let the Coal Board get into difficulties, and the Government will clap it on again as quickly as they have removed it!

NOTES AND COMMENTS

The B.A.C. Vote

A GENERAL ballot of members of the British Association of Chemists, as indicated in our issue of July 20 (p. 65), is to be taken on the proposal made by the Council of that Body to affiliate with the Trade Union Congress. That is a private matter for the B.A.C. into which it would be inappropriate to venture, were it not that the move involves a principle affecting the many chemists who are or may in the future be members of the B.A.C., and consequently is of general interest to the profession. We suggest that certain points might well be taken into account by members who are now recording their views on the ballot papers provided. The question of political or strike action, for example, is one of the most contentious in the whole discussion. The Council of the B.A.C. appears to believe that the T.U.C. is non-political. It is no doubt true that the T.U.C. is not financed from out of the political funds of its constituent unions. It is true that it cannot spend its funds on the promotion of Parliamentary candidates. It is true that the T.U.C. and the Labour Party are separate bodies. But it is also true that the T.U.C. is inevitably bound to discuss political matters and adopts resolutions stating its views: these resolutions are generally in line with the ideas of the Labour Party, and the T.U.C. and the Labour Party quite evidently travel along the same path, even though at times one may diverge to pick a flower that the other has not seen or does not want. We do not find, however, that affiliation with the T.U.C. need be resisted on these grounds.

Chemists and Strike Action

MORE serious is the demand on the part of the T.U.C. that its constituent unions must "work with and not against" the main body. This is quite understandable, but where does it lead us? It leads to the position that while an affiliated union would not be under obligation to take part in strike action on behalf of another union—though it might be morally difficult to avoid doing so—"in the event of any other union being involved in a strike, the B.A.C. would be expected not to act in any way against its members." No one expects chemists to act as strike breakers, but our own past experience has been that when a strike has been declared, certain parts of the works which cannot be readily stopped without injury are kept in operation by the aid of the staff. The chemists are not workmen; they are staff. It would be most detrimental to the profession if affiliation to the T.U.C. resulted in a refusal on the part of the chemists to carry out the normal duties necessary for keeping the plant from damage, which have always been the privilege and responsibility of the staff.

The Indignity of Compulsion

THE Council of the B.A.C. is apparently quite happy that although the Association may lose quite a number of members if it becomes affiliated, "it is doubtful if their number would be at all substantial." It is found that this loss might well be balanced by the many members who are becoming restive because they fear that what is projected is in fact coming to pass. The Association appears from this statement to be losing ground anyway, and the Council clearly feels that those who will go should go, and may possibly have gone already. Thus "it may well be that the B.A.C. is already experiencing this particular disadvantage of affiliation without getting the counter-advantages." Membership of the B.A.C. is an internal affair, with whch we need not concern ourselves; what is more important, however, is the extent to which chemists may be compelled to enter the trade union after affiliation. There have been plenty of instances where trade unionists have struck because certain of their colleagues did not belong to their union. Are we likely to find the same sort of thing with the B.A.C. in time to come? That anything of this sort should occur would seem to our uninstructed mind to be something of the last indignity that could happen to the chemical profession.

The Question at Issue

THE issue is important because it is an outstanding example of the merging of a professional body—if the Council's motion is approved—in the trade union movement. That some other professional bodies have become affiliated is beside the point. The issue might even become whether ultimately the B.A.C. will comprise only juniors and laboratory assistants, to whom the idea of uniform wages and

common action may be entirely appropriate, or whether it will continue to include senior chemists as well. The jury has already retired to consider its verdict; we shall wait the decision and its outcome with considerable interest, and no little sympathy. The B.A.C. has done very valuable work in the past. Long may it continue to do so.

Patent Medicines

ON the whole, the chemical industry proper is not directly concerned with the manufacture of "patent" medicines, which are more correctly described as "proprietary" medicines, since medicines cannot now be patented. Many fine chemicals, however, go into the concoction of these materials, and it is fitting, therefore, that the industry should have some notion of what is beng said and done around the subject. The Pharmaceutical Society keeps a watchful eye upon them, with the result that nowadays there are few if any really "quack" medicines in existence. It is the method of distribution, rather, which exercises the minds of reputable pharmacists to-day, and there is undoubtedly much that could be done to improve things in this direction. The case is put succinctly in a pamphlet, "Patent Medicines: An Indictment," by Mr. H. Linstead, M.P., secretary of the Pharmaceutical Society, which has just been published by *National News-Letter*, and which, we understand, is obtainable only from them, at the price of one shilling.

An Indictment and a Remedy

DEALING with both the past and the future, Mr. Linstead states his case plainly, ending with an indictment followed by suggestions on what should be done. The main objection to the present system is that the advertising of "patent" medicines makes the public disease-conscious and creates an atmosphere of fear. Testimonials of little value and exaggerated claims are rife; and, by implication, public confidence in a State medical service and in registered practitioners is undermined. In certain instances excessive prices are charged, and psuedo-scientific language is often used. We are reminded of the "patent medicine advertisement" for water, in a magazine competition, which described that universal panacea as "calcined protium." The main remedy suggested by Mr. Linstead is that the Minister of Health should accept responsibility for the oversight of proprietary medicines, and that a register of medicines should be compiled, those not complying with the regulations to be withdrawn from the register and their sale made illegal. This is just an outline of the detailed proposals made. We suggest that Government officials would be better employed in considering the terms of this much-needed reform than in altering the names of innocuous biscuits.

Wholesale Prices in July

THE most striking feature about the trend of wholesale prices in July was the very steep rise in non-ferrous metals, as measured by the Board of Trade index figures. The advance of 12.4 per cent. over the June figure is one of the biggest recorded among industrial materials for some time past, the current figure being 161.2 as against 143.4 in the previous month (1930=100). Six of the eight items in this group were affected, zinc rising by as much as 27½ per cent., English lead by 21½ per cent., and electrolytic copper, copper wire, and copper solid-drawn tubes by 16½, 15, and 9 per cent. respectively. Brass strip or sheet advanced by 14 per cent. Under the head of "chemicals and oils" the rise was 1.0 per cent., the chief contributory items being white lead paint (9 per cent.), soap (5½ per cent.), and copal varnish (slightly over 4 per cent.). Fertilisers recorded a fall of a little over 6 per cent., the final index figure for all chemicals being 147.6, compared with 146.1 in June. Iron and steel advanced by 0.6 per cent. from 205.2 to 206.4.

A Philosopher's Passing

WHILE these columns were being written, news came to hand of the passing of a man whose influence on the modern attitude to science and scientific education has been of the profoundest. H. G. Wells died on August 13 at the age of 79. Some journalistic play has been made with the date and with the number of his house—13 Hanover Terrace—but, surely no man has had better fortune in his work, nor better deserved it. Whatever opinion one may hold of his philosophy, there is no question that Wells—B.Sc., London, with honours—did much to put the scientist right with the public. No great scientist himself—his mind was too volatile—he fully understood the scientific viewpoint, and his writings did good service in displaying the scientific worker in relation to ordinary life.

Nickel in War-Time Germany

Recovery from Low-Grade Ores : Production of Powder

by DAVID D. HOWAT, B.Sc., Ph.D., F.R.I.C., A.M.I.Chem.E

ONE of the most important gains secured by Germany when Finland became its ally in war was the winning of almost the total output of nickel ore from the mine at Petsamo. This copper-nickel ore deposit in the far north of Finland represented practically the only source in the world from which Germany could obtain the relatively small but absolutely essential quantities of nickel required for war industries. Some useful light has been thrown on the nickel industry in Germany during the war by two recent reports.*

According to these reports, maximum production from the Petsamo mine was about 350,000 metric tons per year, the ore containing about 2½ per cent. copper and 4½ per cent. nickel. The total output of ore from the Petsamo mine was to be treated in three separate smelters: the Petsamo smelter, with a capacity of 250,000 metric tons per year; the Nord-Deutsche Affinerie at Hamburg, with a capacity of about 60,000 tons per year; and the Hoboken smelter. The last, however, completely failed to reach the target figures.

At Petsamo, with a hydro-electric power station rated at 25,000 kW, the ore was smelted in electric arc furnaces to give a low-grade matte. Each furnace, rated at 10,000 kW, smelted about 550 tons of ore per day, the slag produced containing less than 0.2 per cent. nickel and less than 0.1 per cent. copper. The matte was concentrated in a horizontal converter taking charges of about 4 tons of liquid matte. High-grade matte obtained from the converter contained about 55 per cent. nickel, 25 per cent. copper, 8 per cent. sulphur, and the balance iron and slag, this matte comprising the main raw material supplied to the nickel powder plant of I.G. Farben at Oppau.

Oppau Powder Process

Production of nickel powder at the Oppau plant followed the main lines of the classic Mond process, the nickel being separated from the other constituents of the ore in the form of the volatile nickel carbonyl $Ni(CO)_4$. The salient points of difference in the procedure followed at Oppau as compared with nickel smelting at Copper Cliff in Canada and at Clydach in Wales appear to be:

(1) No attempt is made to effect any preliminary separation of the nickel and copper in the matte as is done at Copper Cliff by the "tops and bottoms" process, the charge being simply the finely crushed matte from the converters.

(2) The nickel-copper matte is treated as a sulphide, while at Copper Cliff and at Clydach the nickel sulphide is oxidised by a preliminary treatment either in D.L. sintering machines or in rotary calciners with revolving hearths.

(3) Volatilisation is carried out under a pressure of 200 atm. as compared with treatment at atmospheric pressure at Clydach. At Clydach, the residue from the preliminary treatment with carbon monoxide is subsequently subjected to a further volatilisation treatment under a pressure of 300 lb./sq. in.

Volatilisation Treatment

The volatilisers employed at Oppau are standard pressure vessels from the ammonia plant, each being approximately 500 mm. internal diameter, 8 m. long., with apertures 120 mm. diameter, top and bottom. They are constructed of creep-resisting steel containing 0.5 per cent. chromium, tungsten, and molybdenum, the inner surfaces being corrugated. The arrangement employed is to group four pressure vessels together to form a unit assembly, each assembly taking a charge of 20 tons of crushed matte. The reaction chambers are heated to a temperature about 250° C. Carbon monoxide gas, preheated by steam and electric heaters, is admitted to the vessels at a pressure of about 200 atm., the gas supply being obtained from the ammonia plant. The rate of circulation of the gas is about 30 cu.m. (measured at 200 atm.) per hour. The actual time occupied for the volatilisation treatment is three days, with one day for charging and one for discharging, thus enabling about six cycles to be effected per month. About 85 per cent. of the nickel is removed from the charge during this time.

The gases escaping from the top of the chambers contain the volatile nickel carbonyl together with various quantities of iron carbonyl as an impurity. After passing through copper gauze and flannel filters to extract the dust, the gases are cooled and passed through condensers to collect the liquid nickel carbonyl, the carbon monoxide being recirculated to the reaction chambers. The liquid nickel carbonyl after passing through a pressure-reducing trap is collected in storage tanks where it is maintained

* *CIOS* XXIV-12, I. G. Farben, Oppau Works, Ludwigshafen (H.M.S.O.; 1s. 6d.); *BIOS*. 263, I. G. Farben, Oppau, and Nord-Deutsche Affinerie, Hamburg (H.M.S.O.; 2s. 6d.).

under a pressure of 5 atm. of carbon mon oxide. The liquid carbonyl is distilled to enable the nickel carbonyl (B.P. 43° C.) to be separated from the iron carbonyl (B.P. 103° C.). Fractionation is carried out under a pressure of about ½ atm. with a maximum temperature of 80° C.

From the distillation plant the liquid nickel carbonyl passes through a vaporising cylinder, the gas being then fed to the de composers. These are cylindrical chambers maintained at a temperature of 220/240° C. and under a pressure of 200/400 mm. w.g. over atmospheric. The nickel carbonyl decomposes, forming nickel powder and liberating carbon monoxide gas which is re-circulated. The German flow-sheet is shown in Fig. 1.

At Oppau three forms of nickel powder are produced. The standard powder, with an average particle-size of 4-8 μ, is used mainly for steel manufacture, drums of the powder being charged directly to the open hearth steel furnaces. A powder with a finer particle-size of approximately 2 μ with a packing density of 0.8 kg. per litre, is produced for the manufacture of accumulator plates. A special high-purity powder (carbon 0.02 per cent., iron 0.01 per cent., and sulphur 0.0005 per cent.) with an average particle-size of 4 μ is produced in small quantities.

The residue from the Oppau volatilisers, containing about 70 per cent. copper, 3-4 per cent. nickel, with the balance mainly sulphur, but carrying appreciable quantities of the precious metals (gold 5 g./ton, and platinum plus palladium 15 g./ton) is sent to the Nord-Deutsche Affinerie at Hamburg.

Smelting and Refining

Some useful information is given on the operations carried out at N.D.A., Hamburg, on the treatment of the nickel copper ore from Petsamo and on the recovery of the copper and the precious metals from the residues from Oppau.

Smelting of Petsamo ore, which began late in 1941, comprises sintering on D.L. machines, blast-furnace smelting of sinter and crude ore to produce matte, and the treatment of this low-grade matte in converters to give high-grade matte suitable for the nickel powder plant at Oppau Rough crushed ore as received from Petsamo has the following approximate analysis:

	Per cent.
H_2O (moisture)	2.42
Cu	2.42
Ni	4.42
Al_2O_3	3.3
Fe	26.8
SiO_2	20.0
CaO	1.3
S	13.6
MgO	24.9

After crushing to 8 mm. size, about two-thirds of the ore, with blast-furnace flue dust and silica sand as flux, is treated on a D.L. sintering machine, 1.5 by 12 metres. About 60 tons of sinter are produced per shift from this D.L. machine, the average composition of the product being:

	Per cent.
Cu	1.59
Ni	2.78
Fe	22.59
SiO_2	41.25
CaO	1.55
MgO	9.75
S	2.25

Smelting for low-grade matte production is carried out in a blast furnace, measuring 1.10 by 6.40 m. at the tuyere zone and with a capacity of about 60 tons of ore per day. Charge to the blast furnace comprises crushed Petsamo ore, to the extent of about one-third of the total received by the smelter, sinter from the D.L. machines, converter slag, converter shells, and lime and silica sand as fluxes. A typical charge made to the blast furnace is as under; for this weight of charge 511 kg. of coke, equal to 17 per cent. of the charge weight, would be added as a separate layer.

	kg.	Per cent.
Petsamo ore direct	777	25.89
Petsamo ore sintered	1160	38.60
Converter slag	322	10.73
Returned matte (B.F. and converter)	52	1.74
Rejects, converter shells, etc.	185	6.13
Limestone	254	8.46
Silica sand	183	6.11
Return slag	67	2.28
Total	3000	100.00

The usual practice with blast-furnace smelting for matte production is followed, the charge running continuously from the furnace into an external settler. Slag over flows continuously from the settler while charges of matte are tapped from the bottom at intervals for treatment in the converter. The low-grade matte produced contains 23 per cent. nickel, 15 per cent. copper, 37 per cent. iron, and the balance sulphur, while the slag carries 0.28 per cent. nickel, and 0.20 per cent. copper. The slag composition is controlled to give a magnesium/calcium ratio not exceeding 2/1, which ensures a reasonably fluid slag giving little trouble in the settler.

Horizontal Converters

Converters employed are of the usual horizontal type, 2.5 m. dia., some being 3.3 m. long, and others 4.6 m. long. Air at 15 lb./sq. in. is supplied through 18 tuyeres in each converter. Low-grade matte when blown in the converter yields about 2¼ tons

of slag for each ton of high-grade matte produced, the usual finished charge being about 6 tons of high-grade matte. Blowing is continued after the removal of the iron until the sulphur content has dropped to about one-quarter of the copper content, the usual blowing time required being 9-9½ hours. High-grade matte produced contained 37 per cent. nickel, and 50 per cent. copper, and the balance mainly sulphur, with less than 0.5 per cent. of iron and cobalt. The converter slag, returned to the blast furnace for further treatment, contains about 4.2 per cent. nickel, and 2.6 per cent. copper. The high-grade matte is cast into slabs, which were subsequently broken up before being shipped to Oppau.

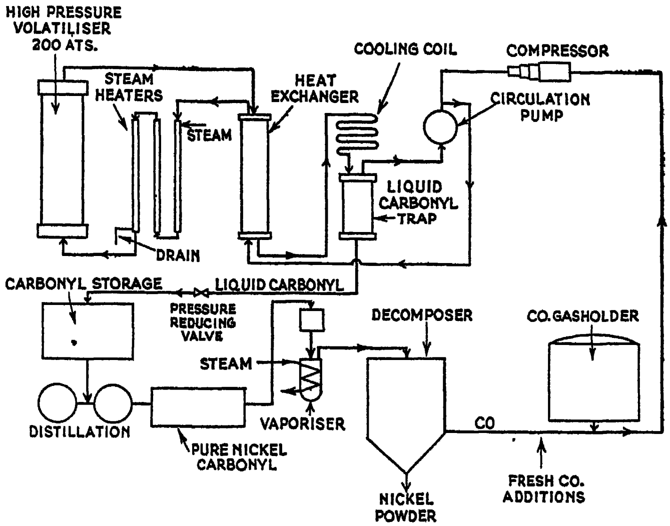


Fig. 1. Diagrammatic flow-sheet illustrating the manufacture of nickel powder at the I.G. Farben plant, Oppau, Germany.
(*B.I.O.S. Final Report No.* 263, *Item No.* 21).

Treatment of Residues

A further section of the reports is concerned with the treatment of the copper-nickel residues received back from Oppau after the extraction of the nickel in the form of the carbonyl. As these residues contain a high percentage of copper and only small quantities of nickel they are treated in the usual manner for copper concentrates. That system of treatment comprises smelting in reverberatory furnaces to produce high-grade copper matte, blowing the matte to "blister copper" in the converter, and preliminary fire-refining of the blister copper, which is then cast into anodes for electrolysis. During the electrolysis of the copper anodes the precious metals accumulate in the "anode mud," while the small percentages of nickel dissolve in the electrolyte. The anode mud is treated for the extraction of the precious metals.

To recover the nickel in the electrolyte, quantities of the solution are withdrawn from the end tanks of the banks of cells and the copper removed by stripping in separate cells fitted with lead anodes. The solution, from which the copper has been stripped, is then treated in batches by heating to 95° C. in the presence of metallic copper, the greater part of the arsenic and antimony being precipitated as copper arsenide and antimonide. The filtered solution is then evaporated and the greater part of the nickel crystallised out as anhydrous nickel sulphate, the sulphate being further purified by recrystallisation. To recover the nickel in the metallic form the sulphate is converted to the carbonate by precipitation with soda ash. Quantities of the nickel carbonate are then added to the electrolyte in a separate tank for the production of electrolytic nickel. In this tank the electrolyte is maintained at a nickel concentration of 90 gm./l., with a free sulphuric acid content of 2 to 3 gm./l. Lead anodes are employed while the nickel is deposited on aluminium cathodes from which the deposit is stripped at intervals, the current density employed being 175 amps./sq. metre.

Manufacture of Iron Powder

The raw material for the manufacture of iron powder is *Eisenstein*, containing approximately 92 per cent. iron and 8 per cent. sulphur. This alloy is prepared by melting together steel scrap and iron pyrites in a rotary furnace, the melted charge being poured into flat slabs.

The *Eisenstein* is broken and crushed to a maximum particle-size of about 10 mm. and then charged to the reaction cylinders, which are practically duplicates of the nickel-powder reaction cylinders. Carbon

monoxide gas at a pressure of 70 to 200 atm. is fed to the cylinders which are maintained at a temperature of 200°-220°C. for about four days. At the end of this period about 70 per cent. of the iron in the *Eisenstein* is converted to iron carbonyl, the solid residue being returned to the melting furnace. From the reaction cylinders the gases pass to coolers and condensers in which the liquid carbonyl is separated.

Liquid iron carbonyl flows into vaporising cylinders heated by steam coils, the vapour produced passing into the decomposing cylinders. The decomposers, 3 m. high by 1 m. dia., are operated under normal pressure and maintained at a temperature of 240°C. The iron powder formed by the decomposition of the carbonyl contains 0.6 to 1.2 per cent. carbon. Although a certain small percentage of dry ammonia gas is introduced into the decomposers to reduce the tendency of the carbon monoxide to decompose, through the catalytic effect of the finely-divided iron, a certain degree of decomposition is inevitable, the carbon so produced being immediately absorbed by the iron powder. The iron powder collects in a chamber at the base of the decomposer from which it is removed by means of a collapsible rubber sleeve.

To reduce the carbon content and to eliminate traces of carbon monoxide gas and oxides, the iron powder is heated in reduction furnaces at a temperature of 400°-500°C., an atmosphere of hydrogen being maintained. These furnaces (*Gluhofen*) are horizontal steel chambers, 4 m. long, 1.5 m. wide, and 250 mm. deep, heated by electric resistance coils. Gas content of the powder after treatment is claimed to be not more than 0.1 per cent. of hydrogen and nitrogen. Production of iron powder during the war was at the rate of approximately 20 tons per week. The main uses of the product are for electromagnetic purposes, principally the manufacture of the well-known Puppin cores, and for accumulator plates.

Control of Particle-Size

The average particle-size and the packing density of the metal powders produced by these methods are determined largely by the conditions in the decomposers. A high rate of production, corresponding to a fast throughput of gas, and a high operating temperature, accelerate the decomposition of the carbonyls, giving a light powder, with small particle-size. Alternatively a slow rate of production, corresponding to a slow gas flow, gives a heavy powder with larger particle-size. The same effect is obtained with a higher decomposer chamber, the greater height giving a longer distance of travel for the particle in falling to the bottom, and leading to the formation of larger particles by the decomposition of more metal during the period of fall. In the case of nickel-powder manufacture the extreme limits of rates of production are from 300 kg. to 1500 kg. of powder per unit per day.

The main types of iron powder produced were: Grade E, with about 0.6 per cent. carbon and 0.1 per cent. nitrogen; Grade C, made by decarburisation of Grade E, containing 0.04 per cent. carbon; and Grade H, produced by air elutriation of Grade E, composed of the finest particles, averaging 1 to 2 μ in diameter.

Nickel Compounds

Research Fellowship Sponsored

IN connection with the German work on nickel described above, it is interesting to record some of the investigations which are being covered by a multiple research fellowship sponsored by the International Nickel Co. at the Mellon Institute, Pittsburgh, Pennsylvania, as noted in the report of the Director of the Institute (Dr. E. R. Weidlein) for 1945-46. New nickel compounds and catalysts of special promise are being prepared and are under study in cooperation with industrial and government laboratories.

Nickel arsenate and nickel ethylene bis-dithiocarbamate are possible pesticides for agricultural use; and nickel arsenate, naphthenate, and sulphate are giving interesting results in long-term wood-preservation tests. Exhibiting suggestive properties are nickel dibutyldithiocarbamate, oleate, and stearate as lubricant additives; substitute carbonyls and β-diketone derivatives as motor fuel additives; and nickel diethyldithiocarbamate as an anti-oxidant and accelerator for rubber. The familiar red dimethylglyoxime nickel derivative, as well as the maroon α-furyldioxime compound, and several other less familiar organic complexes are being investigated as pigments; and nickel chromate as a corrosion-inhibiting pigment.

Catalysts are being made from organic compounds of nickel such as the formate and oxalate, from new alloys of the Raney type, and by the precipitation of a great variety of compounds ranging from pure hydrated nickel oxide to complex mixtures such as nickel tungstate-sulphide. Efforts are being exerted to develop catalysts with more highly reproducible properties, active over wider temperature ranges, and more resistant to poisoning. Collaborative projects in catalytic hydrogenation, dehydrogenation, and desulphurisation, especially in petroleum chemistry and the synthesis of liquid fuels, are leading to valuable information on nickel catalysts for industrial use.

The Drug Called BAL

Treatment of Arsenical and Other Heavy-Metal Poisoning

by G. COLMAN GREEN, B.Sc., F.R.I.C., A.M.I.Chem.E.

IN the handling of all toxic materials prevention is better than cure, and this is especially so when the cure is non-existent or of dubious efficacy. The situation becomes extremely serious when preventive measures are uncertain in efficiency from one cause or another and the cure is non-existent.

Until recently there existed no cure for arsenical poisoning, at least, in the chronic stage. Antidotes in the acute stage were effective in a degree depending greatly upon circumstances. Thus it had become imperative that industrial hazards from arsenic intoxication such as might be met with in the manufacture of pigments, glass, weed-killers, insecticides and medicinal chemicals should be subject to control by positive and reliable preventive measure. Personnel who contracted arsenic poisoning despite all precautions were doomed to a spell of pretty poor health in the best circumstances.

Types of Arsenic Poisoning

However, the risks of arsenic poisoning are equally great in the world outside these industries concerned with the handling of arsenical material. For example, in the past it has been possible to digest toxic amounts of arsenic with contaminated foodstuffs. This hazard has been brought almost completely under control in this country since the Royal Commission on Arsenical Poisoning recommended in 1903 that no substance used in the manufacture of food or drink should contain more than 1.4 parts per million of arsenic as As_2O_3. By contrast criminal poisoning by arsenic is still far from being under control and it remains one of the commonest methods of such poisoning, the incidence differing in various countries mainly with accessibility of material. In this last category may be included, by a selection of moral emphasis, the use of arsenical chemical warfare agents such as lewisite, against the effects of which there was no known cure up to the outbreak of the late war.

An unusual set of circumstances arises in the administration of arsenical drugs for therapeutic purposes. Here the ingestion is deliberate, and the risk of some degree of toxic action especially during prolonged treatment fairly certain. It is not surprising if some attention has been directed towards detoxification in this class of problem rather than in those mentioned earlier, principally because the drug is administered under direct medical supervision.

The use of arsenic derivatives in medicine has become of great importance in the treatment of disease and, indeed, the era of chemotherapy was heralded by Ehrlich's introduction of the trypanosomicidal arsenicals in 1909, and particularly arsphenamine ("Salvarsan" or "606"), for the treatment of syphilis and other trypanosome infections. Since that date a number of aliphatic and aromatic arsenic derivatives have been introduced to combat these parasites; their advantage is that, on account of the slow cleavage of arsenic as a result of the metabolism of such compounds, the toxic effect of these compounds is milder and more delayed than when the arsenic is administered in an ionic form. It is because of the relatively high toxicity of arsenic in the ionic form that the manufacture of these arsenicals is subject to the rigid requirements of the Therapeutic Substances Act. Thus the compounds do not become available until it has been ascertained that they are free of the toxic ionisable form of arsenic with which they might be contaminated as a consequence of errors of manufacture.

Even when free of ionisable arsenic the fact remains that these drugs are toxic to the host as well as to the parasites, and what is sought in developing them is, *inter alia*, as large a margin as possible between the maximum tolerated dose and the minimum curative dose. The ratio of these quantities is Ehrlich's "Chemotherapeutic Index." Of course, even where this margin is wide, statistical consideration as well as individual idiosyncrasies are involved, so that the need for detoxification may arise during or at the end of treatment.

Toxic manifestations may take a variety of forms according to circumstances, resulting in damage to the capillary endothelium, rigor, headache, cramp, exfoliative dermatitis, etc., and the liver is particularly likely to be damaged.

Attack on Systemic Poisoning

Until recently no satisfactory antidote in systemic poisoning has been available. Where, as in therapy with arsenical chemotherapeutic agents, the metal has become fixed in the tissues, detoxification has been attempted by injection of sodium thiosulphate, but the results are uncertain and the treatment is somewhat discredited.

It need hardly be said that the possible use of arsenical vesicants such as lewisite (chlorvinyldichlorarsine) has raised the question of detoxification in human systemic arsenic poisoning in an even more urgent manner. The attack on the problem began

in the mid-thirties when Peters at Oxford recognised that a precise knowledge of the mechanism of arsenic intoxication was a prerequisite. Coke had observed in 1931 that with thiol (—SH) groups arsenic formed thioarsenites of the type:

$$R.As(SR')_2$$

which had the property of dissociating in alkaline solution. He went on to suggest that by some similar mechanism arsenic poisoning might be reversible *in vivo*. It was known, of course, that arsenic reacted readily with the thiol groups which are universally distributed in living tissues, particularly in the form of glutathione, which is intimately concerned with their anaerobic respiratory processes.

Probable Action of Vesicants

In 1936 Peters suggested that these vesicants inhibited the pyruvate oxidase enzyme system, as iodoacetic acid, dichlordiethylsulphone, and arsenite were known to do. Pyruvic acid is formed as a product of intermediate carbohydrate metabolism and is cleared from the tissues by a number of means, the most important, perhaps, being the Krebs citric acid cycle. In this cycle the pyruvic acid first reacts with oxaloacetic acid and then, passing through a sequence of nine reacting aliphatic acids, it is first built up to a 6-carbon chain acid, and then degraded to carbon dioxide and regenerated oxaloacetic acid with which further pyruvic acid reacts. At each degradative step from the 6-carbon acid a small amount of energy is released for coupled synthetic reactions in the tissues which are, at the same time, protected from sudden heat changes.

Aneurin (thiamine; vitamin B_1) in the form of its diphosphate, co-carboxylase, is implicated in the oxidative removal of pyruvic acid by means of the Krebs citric acid cycle, and any inhibition of the action of co-carboxylase leads to the accumulation of pyruvic acid in the blood, a lesion which is characteristic of vitamin-B_1 deficiency. Since this system is inhibited by arsenic it was possible to use the accumulation of pyruvic acid as a yardstick of arsenic intoxication and its clearance as a yardstick of detoxification, in experimental work.

Cameron, in 1942, reported experimental work in which he labelled serum albumin, by allowing it to react with a diazonium hydroxide of the trypan blue type, and found that systemic lewisite poisoning involved loss of blood plasma at sites which were widely spread throughout the body. It became apparent, therefore, that a detoxifying agent was required which, in addition to being sufficiently non-toxic itself, was capable of reaching the whole vascular system, which would prevent the arsenic that might be present in the blood stream from penetrating into tissues, which would remove arsenic from cells already penetrated, and which would form a readily excretable complex with the arsenic.

The knowledge that arsenic reacted readily with thiol groups led to an examination of a series of monothiols as detoxifying agents, but without success. Stock and Thompson at Oxford made a detailed study of keratein (the reduced form of keratin) with arsenic and found that when tervalent arsenic combined with a pair of thiol groups in one molecule a stable ring system was formed. A dithiol compound was now sought which, in addition to being non toxic itself, would contain sufficient polar groups to impede its own diffusion into cells, since it was thought that such lack of diffusibility would promote the withdrawal of dissociated arsenic from the cells into the blood stream and the subsequent renal secretion. In short, the arsenic fixed in the tissues would partition itself between the tissues and the detoxifying agent in the blood-stream in such a way that the distribution would be in favour of the latter.

A Suitable Dithiol

A search of a large number of dithiols led to the choice, as the most satisfactory agent, of 2 : 3-dimercapto propanol ($CH_2SH.CHSH.CH_2OH$), or dithioglycerol called "British Anti-Lewisite," or BAL for short —which reacts with lewisite thus:

$$\begin{array}{l} H_2C—SH \\ HC—SH \\ H_2C—OH \end{array} + Cl_2As.CH : CHCl$$

$$\longrightarrow \begin{array}{l} H_2C—S \\ HC—S \\ H_2C—OH \end{array} \!\!\!\!\!\!\!\!\!\!\!\!\! \quad \begin{array}{l} \diagdown \\ \diagup \end{array} As.CH : CHCl$$

BAL, in accordance with postulate, was found to diffuse into cells slowly and so was distributed mainly in blood and intracellular fluids, and the complex with lewisite was found to be excreted rapidly in the urine. *In vivo*, BAL was found to stop local damage to tissues by lewisite and to check signs of systemic poisoning. Its clinical use in arsenic poisoning has been developed in both Britain and the U.S.A. In the latter country it was found that, applied by inunction, it was able to penetrate the skin, protect the test enzyme, and prevent the accumulation of pyruvic acid; moreover any fixation of arsenic in the cells which had occurred was reversed. In 1943 arsenical dermatitis and encephalitis was successfully treated in the U.S. by means of BAL by inunction, but this method was later superseded by intramuscular injection of BAL in 10 per cent. benzyl benzoate in pea-nut oil. Further, considerable evidence is forthcoming from the U.S. that BAL is effective in the treatment of poisoning by other metals such as mercury (also used in chemotherapy) zinc, and cadmium, so

that the range of usefulness of the drug appears to be on a wider basis than could have been hoped for.

"BAL-intrav." has been developed in Britain for intravenous injection and this is a solution of the O-glucoside of the dithioglycerol.

McCance and Widdowson more recently have reported that BAL is essentially non-toxic to man and has no allergic properties.

Thus, from the exigencies of war has come a therapeutic agent which combats arsenic and probably heavy-metal poisoning in general in all the ways in which it may arise, whether industrial, therapeutic, or plainly criminal, and with potentialities yet to be fully explored. Not the least interesting feature of the development has been the rational biochemical approach to the central problem, and in this the British workers have acquitted themselves with distinction.

Chemical Kinetics

Some Aspects of Russian Physico-Chemical Science

by PROFESSOR B. BERKENHEIM

THE Academy of Sciences Institute of Chemical Physics, which was founded by Academician N. N. Semenov in Leningrad in 1931 and later transferred to Moscow, where it is still working, is one of the youngest but nevertheless one of the leading scientific institutions of the Soviet Union. Its scientists study some of the most important problems in modern chemistry—the kinetics of chemical processes. This is a field in which many famous Russian chemists have been interested—Bach, Menshutkin, Titov, Shilov, and others who are quite well known.

Academician Nikolai Semenov (standing), with his closest colleague, Nikolai Chirkov, studying the speed of the oxidisation of carbo-hydrates in one of the laboratories of the Institute of Chemical Physics, Moscow.

In the 20th century chemical kinetics has become very important both in theoretical and industrial chemistry. The leading figure in the study of this problem in the U.S.S.R. is Academician Nikolai Semenov, whose development of the chain theory of chemical reactions is well known. His theoretical conclusions have been proved by the experimentation of his pupils. Semenov began intensive development of the chain theory in 1928 and his book, "Chain Reactions," published in Russian and English in 1935, is, according to Professor Hinshelwood, an everyday manual for every scientist engaged in chemical physics.

The chain of chemical reactions gets its name from the fact that a primary reaction may give rise to a series (chain) of secondary reactions. The process may be imagined by assuming that in the course of the process of reaction a number of intermediary, unstable products are formed. These inter-

mediary products, entering into a reaction with the molecules of the original substance, form the molecules of the final product of the reaction, and again produce an intermediary product capable of further transformation.

Semenov also developed the theory of what he called the "branching of chain reactions," the breaking of the chain on the walls of the vessel in which the reaction is taking place and in its volume (this simultaneously with Hinshelwood), heat explosion and a number of other fundamental problems in the theory of the course of chemical processes.

Intermediary Reaction Products

During recent years the greatest attention has been paid to the discovery and identification of intermediary active substances which give rise to the chain process. Professor Kondratiev, Corresponding Member of the Academy of Sciences, made a spectroscopic analysis of intermediary products of the combustion of hydrogen and discovered the formation in the course of the process of a considerable quantity of the univalent radical hydroxyl (OH). Also with the aid of the spectroscope, Emanuel showed the presence of sulphur monoxide (SO) as an intermediary product during the oxidation of hydrogen sulphide. Newman, who used the polaroscope method to investigate the oxidation of the hydrocarbons, showed that active intermediary products of the oxidation—peroxides and aldehydes—are accumulated in the course of the process in accordance with the laws of the chain theory. Neuman's work is of interest for the study of the process of the combustion of gas mixtures in motors. This aspect of the work at the institute is under the direction of Professor Sokolik, and has already produced practical results.

Academician Semenov and his fellow-workers and students are likewise noted for their work on the theory of combustion. Of special interest is the work of Professor Zeldovich, who produced a regular theory of the slow spread of flames; he developed, too, a theory of the limits of ignition and the limits of detonation, and improved on the theory of detonation waves.

The transition from slow combustion to detonation is another subject of theoretical interest and practical importance. This problem was studied theoretically by Professor Zeldovich, and experimentally by Shelkin and Belayev. Shelkin represents the mechanism of the transition from combusion to detonation as the result of turbulescence in the area of the combustion. He proved it experimentally by providing artificial conditions for increased turbulescence by introducing artificial obstructions in the tube in which the flame was burning—using a wire spiral, for example, Belayev analysed the same question in its application to secondary explosive substances. Professor Hariton heads the Institute's work on the study of the combustion and detonation of condensed explosives. The results of his work have found application in a number of practical fields.

Theory of Catalysis

Another important branch of the work of the Institute of Chemical Physics is connected with the name of Professor Roginsky, Corresponding Member of the Academy of Sciences, who worked in the Institute up to 1941, when he transferred his work to another institute—the Institute of Colloido-Electrochemistry of the Academy of Sciences. The professor works in the field of catalysis and has developed a theory connecting catalytic action with the extent of the deviation from equilibrium during the preparation of the catalysts. Roginsky and his students have done important work on the study of gaseous promoters whose action is explained by Roginsky as being due to the chemical homogeneity which gives rise to the active qualities of the surface of metals and other catalysts. He has also studied the mechanism and kinetics of catalytic reactions (especially carbon, hydrogen, and nitrogen oxides), and other problems. Roginsky and his students have studied the application of the use of "marked atoms" to the study of the mechanism and kinetics of catalytic reactions.

The research work done by Academician Semenov and his school is acclaimed by all scientists working in the field of chemical kinetics and the theory of combustion.

MINERALS IN GUATEMALA

According to a report on the utilisation of Mineral Resources of the Republic of Guatemala, prepared under the auspices of the Inter-American Development Commission at the request of the country's Government, Guatemala offers prospects for the production of a number of minerals which are gradually becoming exhausted in the United States and which are, generally speaking, in not too plentiful supply in the Western Hemisphere. Gold, silver, and chromite are at present being mined in the Republic, but deposits of lead, zinc, and copper could well be developed. It is also possible that iron and petroleum may be found in workable deposits. Iron-ore occurrences in the Department of Chiquimula are being examined by representatives of a large steel company in order to determine their extent. Among non-metallic minerals which may be further developed, mica and quartz crystals are mentioned, and commercial opportunities may also be offered by lime, clay, feldspar, and silica.

Sealing a Rotating Shaft

Metal Bellows Construction

by ROLT HAMMOND, A.C.G.I., A.M.Inst.C.E.

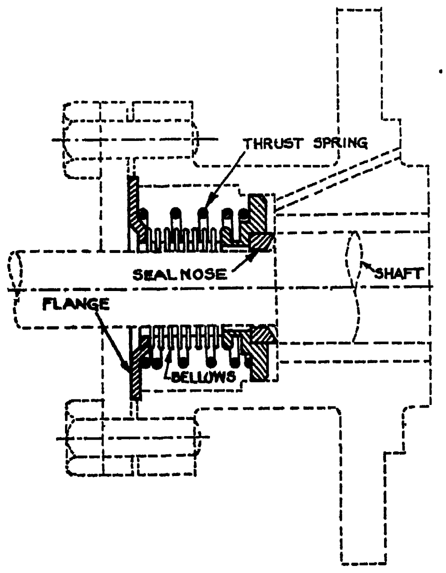
THE problem of providing an efficient seal for a rotating shaft projecting from a closed system is one with which engineers are constantly confronted. The bellows shaft seal illustrated is an excellent solution and has been well tried in service; it is particularly suitable for the shaft seal assembly in a refrigeration compressor, but has a wide field of application throughout industry for air compressors, pumps, gear boxes, paper machinery, and chemical plant.

The assembly comprises bellows, flange, seal nose of special metal, and thrust spring; design is critical, practically every component demanding detailed study. For example, the relation between the effective area of the bellows and the diameter of the seal nose bearing ring is an important factor. The seal nose must have adequate mass and rigidity enabling it to withstand distortion during the final diamond facing operation and later at the comparatively high temperatures encountered in service. It is generally made of a high-lead bronze, but selection of the most suitable alloy will depend upon such factors as speed of shaft rotation, hardness of the bearing shoulder on the shaft, character of the mechanical finish, and nature of material against which the seal is being provided

Design of the thrust spring has given as much difficulty as any other item; it must exert correct thrust at its working length, in a direction parallel to and concentric with the axis. It is therefore essential that each spring should be tested individually under load assembly in the seal unit. Under normal conditions, the pressure required to give the necessary sealing varies from 120 to 160 lb./sq. in.; its precise value is determined by the pressure required to obtain a satisfactory seal for loaded bronze seal rings.

It is essential that the spring should be accurately squared at the ends in its working position, thus ensuring uniform bearing pressure and avoiding deterioration of the seal face. It must also be a highly "rated" spring in order to avoid assembly difficulties, such as stretching of the bellows unit well beyond its free length, thereby increasing the difficulty of flange assembly. Where the spring may be exposed to attack by corrosive substances, it can be treated with nickel or cadmium plate. Another design feature is that the outside diameter of the seal ring of the bellows unit is made equal to the mean diameter of the bellows or slightly greater; the effect of the pressure against which the seal operates is therefore balanced out, or tends slightly to increase the pressure at the sealing face.

The Hydroflex metal bellows used in this device is made by the Drayton Regulator & Instrument Co., Ltd., West Drayton, Middlesex, who employ a special hydraulic



Hydroflex bellows shaft seal

process for forming the corrugations. This method of manufacture involves the unrestricted flow of the metal of a thin walled tube under considerable hydraulic pressure in a collapsible die; the metal flows transversely between the die plates as the tube collapses longitudinally, thereby forming the bellows in one continuous operation. The outstanding advantage of this process, as compared with spinning or rolling operations, is that the bellows will be destroyed under high internal pressure during manufacture, should an imperfection or flaw develop in the metal.

The numerous chemical and other processes to which automatic control can be applied are described in "Automatic Control Schemes," published by Negretti and Zambra, Ltd., 122 Regent Street, London, W.1. The booklet is profusely illustrated with clear drawings.

Lactic Acid for the Plastics Industry

Methods of Purification

IN a discussion of the various grades of lactic acid, the *Revue des Produits Chimiques* (1946, No. 1106, p. 95) pays particular attention to the quality demanded in the manufacture of transparent colourless plastics. The specifications required for this material are extremely rigid, *e.g.*, the acidity must be superior to 50 per cent.; chlorides, calculated as chlorine, less than 5 parts per millon sulphates, calculated as SO_4, less than 50 p.pm.; ash, less than 0.05 per cent.; and only traces of iron are acceptable, as this metal reacts with phenols to give coloured compounds. The presence of other metallic salts should also be avoided, as they result in insoluble compounds producing an opalescent effect.

Several processes have been recommended for the preparation of lactic acid of the required grade. A well-known method is that of purification by means of calcium lactate, a process commonly employed in the preparation of edible lactic acid, refining being effected with the aid of carbon black. Another procedure is to convert the calcium lactate into zinc lactate by the addition of a solution of carbonate or sulphate of zinc, and, after filtration, crystallising out the zinc lactate solution. The crystalline material is separated by centrifuging and dissolved in water; the zinc is then precipitated with sulphuretted hydrogen, while the solution is decolorised by means of animal black, filtered, and evaporated *in vacuo*. Advantage is taken of the fact that zinc lactate is the most easily crystallised of all the lactates.

Yet another method proceeds by the oxidation of the organic impurities contained in the acid. Lactate solutions and technical acid are exposed to the action of weak oxidisers, such as the hypochlorites of calcium or sodium, hydrogen peroxide, potassium chromate or permanganate, nitric acid, chlorine, or ozone.

Attempts to separate lactic acid by fractional distillation have not so far proved successful; and ordinary distillation is not commercially practicable, as it has to be carried out at a very high temperature and at reduced pressure. Similarly, solvent extraction by isopropyl ether is inadvisable, because of the highly inflammable character of the solvent.

Recently considerable attention has been devoted by the U.S. Department of Agriculture to another long-established method: purification by means of lactic esters. Broadly, the process consists of preparing organic lactates, *e.g.*, methyl, ethyl, propyl, or isopropyl lactate, and saponifying by means of steam or hot water, at ordinary pressures. The residue is then concentrated *in vacuo* to obtain a purified lactic acid. Details of the method most recently recommended (Filachione and Fisher, *Ind. Eng. Chem.*, 1946, 38, 228) are as follows: methyl alcohol vapour is passed into an aqueous solution of lactic acid, and the vapour escaping from this solution is condensed. The condensate is found to consist of a mixture of ethyl alcohol, water, and methyl lactate. By distillation the methyl lactate can be separated out, and purified lactic acid obtained after hydrolysis. Other organic esters can, of course, be prepared, and catalysts, such as concentrated sulphuric acid, may be used to accelerate the etherification of the acid by the methyl alcohol.

New Control Orders

Iron and Steel Prices

THE control of Iron and Steel (No. 52) Order, 1946 (S. R. & O. 1946, No. 1359), and the Control of Bolts, Nuts, etc. (No. 12) Order, 1946 (S. R. & O. 1946, No. 1358), which came into operation on August 14, provide for higher maximum prices necesitated by increases in railway rates, coke prices, wages, etc. The maximum prices of the main qualities of pig iron are increased by from 4s. 6d. to 6s. 6d. per ton, and of heavy steel by 5s. per ton. Prices of more finished products have been, where necessary, increased by relative amounts. The orders also free wrought iron in any form and cemented carbide hard metal tool tips from control.

French Morocco

Research Developments

FROM Morocco it is reported that an Iron and Steel Research Institute is to be formed with a capital of 10,000,000 francs to undertake the treatment of local iron, and a Lead Research Institute will be formed with an initial capital of 100,000,000 francs to exploit lead resources. Construction of a new foundry at Zellidea will be completed within two years. Another research institute is to be formed to investigate the possibility of creating a chemical industry in Morocco. In order to finance these developments, a preliminary government loan of 5,000,000 francs is to be floated immediately.

SAFETY FIRST

Amenity as a Feature of Chemical Works—II

by JOHN CREEVEY

IF any degree of perfection is to be reached in this matter of amenity at chemical works, adequate attention must be given to what may be described as "personal service rooms." This term is essentially an American one, and the fullness of its meaning is often unknown to works in England. I do not mean to infer that chemical works in England are generally below the American standard of attention devoted to the personal care of the individual worker, for there are works here which can set a very high standard in this connection. Nevertheless, a large number of chemical works might be pointed out as outstanding examples where the worker is regarded simply as a person with certain duties to perform for so many hours per day, and otherwise is little more than a number on the works' pay-roll with National Health and Unemployment Insurance cards, National Identity card, and the like.

"Personal Service"

Some acceptable recommendations regarding personal service rooms, so far as they reflect American practice, have been set down in the *Handbook of Industrial Safety Standards* published by the National Conservation Bureau, New York, in 1942. All such rooms should be mechanically ventilated, and all exhaust ducts from them should discharge to the outside air.

Dressing rooms should be provided wherever the work performed involves excessive exposure to dust, dirt, heat, fumes, vapour, or moisture. For each individual employee whose clothes are exposed to contamination by material which is either poisonous, infectious, or irritating, there should be two lockers provided, one for working clothes, the other for the clothes which the employee wears when reaching and leaving work. Where processes are such that the working clothes become wet or require washing in the interval between shifts, they should be cared for so regularly that there is always a clean and dry set ready for use at the start of each shift, with a spare set in reserve to meet unforeseen emergencies. Dressing rooms should be provided with an adequate number of clothes hooks, boot rails, and stools or other seating accommodation.

For women employees there should be a retiring room as well as dressing rooms, if ten or more women are employed; even with a smaller number of women employees equivalent accommodation should be provided by a screened-off part of the dressing room, which is adequately lighted and ventilated by outside air. The minimum floor space required for a separate retiring room for ten women should be 60 sq. ft., increasing by 2 or 3 sq. ft. for each additional woman employed. One couch of approved hospital pattern should be provided in every retiring room.

Toilet facilities in general should be readily accessible to employees, and never more than one floor above or below the regular place of work. Certain standards of accommodation have been set down in regulations made under the Factory Acts, which should be consulted. Concerning American practice, *at least* two wash-basins with adequate water supply are considered to be the minimum for any number of persons up to ten, the accommodation being increased by one wash-basin for each additional ten persons up to 100, and thereafter one wash-basin for every 15 persons. Where there is likelihood of skin contamination by poisonous, infectious, or irritating material, the wash-basin accommodation should be doubled, *i.e.*, there should be one wash-basin for every five persons. Where washing facilities in the form of long sinks with individual taps are provided in place of separate wash-basins, two feet of sink should be considered equivalent to one wash-basin. Where the long sink is installed, there must also be at least two individual wash-basins, the number rising proportionately with the capacity provided for by the sink.

Water Supply

In all cases both hot and cold water should be provided; in the absence of hot water, possibly with small accommodation for washing, there must be facilities for obtaining hot water by aid of kettle and gas-ring, because cold water alone is inadequate where skin contamination is likely to exist. The likelihood of skin contamination also demands the provision of one shower bath, with ample supply of water, for every 15 persons. If hot water is supplied to this shower bath as well as cold water, means must be installed to control the upper limit of temperature as by a hot-and-cold water mixing valve.

Personal cleanliness is fostered by a general appearance of cleanliness through-

out the works. All machinery, stairways, corners, and similar places where routine cleaning might be neglected, may advantageously be given a coat of light grey paint; this paint is serviceable and will readily reveal any tendency to inadequate cleaning. Waste materials should never be allowed to accumulate, and for the prevention of this it is wise that the foreman of each section of the works should be made responsible for cleanliness in his particular province, with due authority to call and supervise the cleaning personnel. Oil, grease, or other products which have been spilt must be wiped up immediately, so far as existing conditions allow immediate attention. General cleanliness is promoted by "keeping clean," rather than "making clean at intervals."

Good Housekeeping

At every large works, each plant or section of the works should have its own Safety and Good Housekeeping Committee, composed of employees working in that section. Members of such a committee, by rota, should make frequent and unannounced inspections, and their suggestions and criticism should be brought forward for consideration. The highest standard of works cleanliness is reached only in this way, namely, by the proper co-operation of personnel. Cleanliness directed solely by the management of the works is rarely as effective as it might be, but this does not mean that the management can entirely wash its hands of all interest in this aspect of works control. To be familiar with the situation a man must have practical experience of working conditions. Nevertheless, at least one member of the works executive should be responsible for co-ordinating the work of the sectional Safety and Good Housekeeping Committees, and for imposing strict observance of general safety and cleanliness upon employees who disregard this or who are reluctant to take their due share in maintaining such conditions.

The use of shower facilities should be made compulsory where the nature of the work might predispose a man to some industrial skin lesion in the absence of washing thoroughly from head to foot. Wooden sandals or similar protective footwear should be provided for walking from dressing rooms to showers. At some American works, notably those of the American Cyanamid Co., employees attending the showers are requested to walk through a chlorine pool in going to and from the showers; these pools are scrubbed and refilled as soon as each shift has passed through the showers.

In every works where there is likely to be exposure to injurious dusts or other toxic materials, a separate room for the eating of meals must be provided, if no canteen exists. The requisite floor area of such a room should be based on an allowance of 8 sq. ft. per person for any number of persons up to a total of 25 using the room at one time. Posters displayed at suitable positions throughout the works should remind employees to wash their hands before proceeding to take their meals, for reasons æsthetic as well as those of health. For persons handling toxic materials, the pre-meal wash should be made compulsory, facilities being provided adjacent to the place of working as well as the usual washing facilities.

Cleanliness in working is merely one aspect of good housekeeping at a chemical works. There must likewise be attention to such matters as that of keeping gangways plainly defined and free from obstruction. From the constructional aspect, those places where employees commonly walk should have a floor of anti-slip material. Wood floors, moreover, must be kept free from protruding nails, splinters, loose boards, and uneven parts; a hole must be immediately repaired. Spaces beneath benches and stairways should be inspected at regular intervals to see that they do not harbour refuse or waste of any kind; so also should cupboards with solid panel doors which are not often opened. Oily rags and waste must be kept in covered metal containers; the danger of outbreak of fire from this source is not to be disregarded, for it is a serious menace. Lockers or special racks must be provided for the storage of tools; the tools are then out of the way of causing an accident, and they may quickly be found when needed.

Dismantled or inactive equipment should also be moved to a safe place of storage, and not left standing in a position where it may cause obstruction. Any tendency for a pile or dump of "plant junk" to accumulate should be stopped as soon as it becomes evident, irrespective of what may be said in favour of the occasional utility of such junk. Plant parts which have been discarded do not improve by lying idle, exposed to conditions of corrosion and further mechanical damage, and when suddenly pressed into service for temporary use they can be the primary cause of serious accidents.

J. H. Sankey & Son, Ltd., Ilford, Essex, have issued a revised edition of the leaflet describing their Super Acid-resisting Cement, which is being increasingly used in many ways. The special properties claimed for this cement are that it sets in 12 hours to porcelain-like hardness; resists all acids with the one exception of hydrofluoric; withstands temperatures up to 1200° C.; is water-resisting; has exceptional tensile strength; and can be stored any length of time without deterioration. Free copies of the leaflet are obtainable on application to the company.

Patent Law Reform

Joint Chemical Committee's Memorandum

THE *Memorandum on Patent Law Reform*, prepared by the Joint Chemical Committee on Patents, consisting of representatives of the various chemical bodies interested, has now been published in a single handy volume, and is available from the Association of British Chemical Manufacturers, 166 Piccadilly, London, W.1, price 3s. post free. Part I of this memorandum was submitted to the Board of Trade Patents Committee in September, 1944, while Part II, covering the wider aspects of the subject, was submitted in June this year. For convenience it has been thought desirable to print both parts as a single volume, and to make them available to all interested.

The publication deals in considerable detail with the reforms considered necessary in the Patents Acts, some 50 sections of which are affected. The more important proposals are summarised in the following paragraphs, but for a complete summary, reference should be made to pp. 99-109 of the volume itself. Extended proposals concerning third-party rights are embodied in a supplement. It may be noted that a number of the recommendations put forward have already been adopted, and are included in the Second Interim Report of the Swan Committee (Cmd. 6789; *see* THE CHEMICAL AGE, 1946, 54, 469).

Part I, it will be remembered, was a comparatively brief document, consisting of a questionnaire covering the principal points at issue, with the Committee's suggested answers, coupled with the dissenting views submitted by Dr. G. H. Frazer on the questions of Licences of Right and the extension of the power of the Comptroller to consider subject matter.

Summary of Recommendations

In Part II a new criterion of subject-matter is developed on the basis that every invention which is patentable must be a novel industrial application of a new discovery. Every inventor who seeks a patent must show that he has contributed some item of new knowledge to the art, and that his invention (which must be a "manner of new manufacture") is based on that new knowledge.

Part II also defines "invention by selection" on the lines of the Maugham judgment as modified by 16 years of practical testing. An inventor must bring himself within the rules for "selection" if there is a prior disclosure or claim of his invention which is not merely a statement of *desiderata* but prescribes, though only in general terms, the substances, agencies or means by which his invention is effected. In these circumstances the requirements for patentability as a selection from the general disclosure or claim are: (a) discovery of a previously unrecognised advantage shown by the selection and not common in the field of the general disclosure or claim; and (b) limitation to a manufacture based on that discovery. In addition there must, as usual, be novelty (the selected members must not have been specifically mentioned before), and adequate description of the invention (*i.e.*, in this case, of the advantage which justifies the selection).

Proposed Definitions

It is also suggested that the scope of "product claims" should be defined as protecting the product when made by the process described or by any process which is non-inventive over it. This would bring chemical inventions into line with other inventions, and if Section 38A (3) were incorporated in Section 27, Section 38A could be cancelled so far as concerns chemical inventions. Definitions of "chemical process" and "chemical invention" are proposed.

A scheme for Empire patents is outlined, but the inherent difficulties of such an arrangement are recognised.

An important modification of opposition procedure is proposed which includes: (a) notification of anticipations without formal opposition; (b) filing of an agreed "Technology of the Case"; (c) limitation of evidence to statements of facts to the exclusion of argument, leaving the cited documents to speak for themselves; and (d) limited extensions of time for filing evidence. Various detailed amendments of Section 11, including the abolition of *locus standi* requirements, are suggested, and a separate section dealing with opposition on the grounds of "obtaining" and "prior user amounting to publication" is recommended.

Freedom of amendment within the scope of the original disclosure is also suggested in Part II. Amendments which enlarge the claims (always within the scope of the original description) should be allowed subject to Third-Party Rights, a new definition of which is proposed.

So far as patent licences are concerned, the sanction of an infringement action should not be available for terms and conditions which are essentially of the nature of trade agreements, and the patentees should not be allowed to assert rights which extend beyond those granted by the Letters Patent. If this principle (which is accepted by the Swan Committee) is carried into effect, the feeble provisions of Section 38 become unnecessary and a stop is put to many "abuses

of monopoly." It is necessary, however, that every assignment and licence be registered and all terms and conditions be disclosed to the Comptroller, who should have power to open them to public inspection where he finds illegal conditions imposed. This power would be a salutary deterrent against the use of patents to impose a system of private commercial law.

Replacement of Section 27 by a new section setting out the Rights and Obligations of a Patentee is recommended.

Among other proposals made in Part II may be mentioned: general right of appeal from all decisions of the Comptroller; companies to be entitled to be sole applicants for patents; power for an applicant to withdraw a complete specification without abandoning the application; extension of provisional rights by post-dating up to six months; list of office citations to be printed at the end of specification; division of applications on initiative of applicant; printing of refused specifications with consent of applicant; general reduction of Patent Office service charges; availability of duplicate of the office search files for public use; revision of Section 29's welding; correspondence with patent agents to be privileged.

Constitution of the Committee

The following were the members of the Joint Committee as constituted for the preparation of Part II of the memorandum: *Association of British Chemical Manufacturers*: Mr. C. Hollins (Imperial Chemical Industries, Ltd.; *Chairman*), Mr. E. H. Brittain (The Distillers Co., Ltd.), Dr. G. H. Frazer (Therapeutic Research Corporation of G.B., Ltd.); *Biochemical Society*, Mr. F. A. Robinson; *British Association of Chemists*, Dr. G. E. Foxwell; *Chemical Society*, Professor J. T. Hewitt; *Institution of Chemical Engineers*, Dr. Herbert Levinstein; *Royal Institute of Chemistry*, Dr. J. G. Fife; *Society of Chemical Industry*, Mr. H. W. Rowell. Mr. Allan J. Holden and Mr. H. W. Vallender, of the A.B.C.M., served as Secretary and Assistant Secretary respectively. The chairman, Dr. Levinstein, and Dr. Fife were appointed witnesses to give evidence before the Board of Trade Committee.

Benn Brothers' Annual Meeting

Expansion of Trade Journal Services

MR. GLANVILL BENN, the chairman, presided at the 50th annual general meeting of Benn Brothers, Limited, held at Bouverie House, Fleet Street, London, on August 9. The following are extracts from the chairman's speech.

The accounts reflect the greatly extended operations of the company in the twelve months since the end of the war in Europe. The progress has been achieved despite the severe handicaps common to the business community generally still labouring under the frustrations imposed by the retention of many war-time controls. The continued severe rationing of paper to little more than a quarter of pre-war usage is a brake on the restoration of the full normal activities of the company's 15 trade and technical journals, and on the thousands of commercial undertakings they serve who are striving to rehabilitate their businesses after the upheaval of six years of war. Your journals alone have over 400 British producers of goods waiting to advertise, but whose announcements are shut out for lack of space; and some 3500 firms waiting to subscribe to whom, as yet, copies of the journals cannot be supplied. Add a very high proportion of present advertisers who are waiting for larger advertisement spaces and for additional copies, and some idea is obtained of the retarding influence on trade exercised by governmental restrictions.

There has, however, been one relaxation. A freer allowance of paper for export purposes has made it possible for those of your publications which are wholly for distribution overseas to play the fullest part in aiding the British export drive, and for the rest of the journals to carry, on a far larger scale than in previous years, the message of British manufacturers' goods and services to potential buyers in all parts of the world.

The British Trade Journal and Export World has been enlarged to pre-war size. *Industria Britanica*, which, with its important supplement, *Textil*, is printed wholly in Spanish, is circulating more widely than ever throughout the South American markets, while the Portuguese edition is now restored as a quarterly publication. The inquiry bureau facilities of these journals have been more than doubled during the past year and are rendering invaluable service to British manufacturers and exporters on the one hand, and to overseas buyers of British goods on the other. Similar developments, including the restoration and expansion of our overseas agencies, have taken place and are continuing with all our other journals. Excellent progress has been made by the subsidiary company, Ernest Benn, Ltd., which is again resuming its place among the leading book publishers in the United Kingdom.

Reference is made in the report to the

pleasure felt by the board at the return of our pre-war members of the staff who have been serving in H.M. Forces and the Defence Services. Those of us who have returned during the year are especialy grateful to our colleagues who carried on in Bouverie House throughout the fantastic conditions of London at war, and managed to produce journals week by week or month by month without a break, the reputations and circulations of which stand, thanks to their efforts, higher than ever.

So far I have mentioned some aspects of our activities as publishers. But there is one topic of more general interest that deserves thought. Benn Brothers, Limited, is a typical example of private enterprise. You or your predecessors as shareholders provided the original capital with which the business began. That capital increases or decreases in value in proportion as we, the directors and workers in the enterprise manage its affairs well or badly. All of us stand entirely on our own feet. We receive no subsidy, guarantee, or government support of any kind. On the other hand we are all taxpayers. Nowadays the more efficiently we work, the more tax we pay and the greater becomes Mr. Dalton's contempt for us. You will recall his recent jibe that he had no interest at all in the man who paid 19s. 6d. tax in the £. Evidently he overlooks the fact that most of the men in this very small income group are those whose energy and personal initiative have made them leaders in British industry and commerce.

Burden of Taxation

The following figures may be commended to the Chancellor and to the general public as an illustration of the burden of current taxation on private enterprise generally, and on your business in particular. During the seven years since our annual meeting in 1939 Benn Brothers, Limited, has paid to the Government £167,000 in direct taxation and £97,500 in tax deducted from shareholders' dividends—a total of £264,500. In the same period, shareholders have received a net amount of £107,000 in dividends, while more than £22,000 has been paid in non-contributory pensions and retiring allowances without waiting for Beveridge or other governmental schemes. These results are by no means exceptional. Through the 15 trade journals issued from this House we are in touch with countless businesses all over the United Kingdom. There is reason to believe that if other companies would publish tax figures corresponding to those I have quoted, our record, good as it is, would appear by no means unique.

The great majority of business men, as their records show, are patriotic, law-abiding citizens, who contribute the sinews of war and peace. The present Government's policy of wholesale nationalisation, coupled with a curious shilly-shallying between cajolery and threats towards private enterprise, must inevitably bring a reaction sooner or later in loss of confidence. Already uncertainty about their future has led many business men to adopt a cautious attitude, and to restrict their areas of risk-taking. Before a set-back to trade occurs, is it too much to hope that Mr. Dalton will begin to show a little gratitude and encouragement to the providers of his main sources of revenue?

The report and accounts, together with the dividend recommendations, were unanimously adopted. Sir Ernest Benn, Bart., C.B.E., was re-elected a director; and Cassleton Elliott & Co., were reappointed auditors.

Sir Ernest Benn's Jubilee

At the conclusion of the formal business, Mr. Herbert H. Wardle, on behalf of the staff, made a presentation to Sir Ernest Benn to mark his completion of 50 years of active association with the business. The presentation included a cheque for the Boys' Hostel Association which had its beginnings as a permanent memorial to the late Sir John Williams Benn, the founder 66 years ago of the business of Benn Brothers, Limited.

Bauxite and Oil

New Hungaro-Russian Corporations

THE Hungaro-Russian Bauxite-Aluminium Corporation, which was formed in May, following negotiations between the Hungarian and Soviet Governments, and has since taken over all the main Hungarian bauxite and aluminium mines and plants, has now published its production programme for the next three years. Scheduled output will be 400,000 tons in 1946, 500,000 tons in 1947, and 700,000 tons in 1948.

Since Hungary is the most important producer of bauxite in Europe, and bauxite exports play a great part in Hungarian foreign trade, the new corporation is of considerable importance in the Danubian economy.

Two other Hungaro-Russian corporations have been formed for the exploitation of Hungarian oil resources, the one for prospecting, production, and distilling, and the other for refining and distribution. The activity of these companies will be limited to the left bank of the Danube, and will not affect the Transdanubian oilfields owned by the American Standard Oil Company. The area covered has not yet been thoroughly prospected for oil, but it has been officially announced that there are indications of the existence of rich oilfields.

All these corporations have a capital of which half has been supplied by Russian and half by Hungarian interests.

Personal Notes

Sir John B. Lloyd has resigned from the board of the Anglo-Iranian Oil Co., and Mr. F. G. C. Morris has been appointed a managing director.

Mr. R. Boyles, formerly secretary of Swift & Co., Pty., Ltd., specialists in industrial chemicals, Sydney, N.S.W., has been appointed a director of the company.

Dr. D. J. G. Ives, Ph.D., A.R.C.S., F.R.I.C., has been granted the title of Reader in Chemistry in the University of London in respect of the post held by him at Birkbeck College.

Mr. Gilbert Ritchie, who celebrated his golden wedding last week, has been chairman of the Parozone Co., Ltd., chemical manufacturers, Glasgow, since 1931, having joined the company in 1918.

Dr. J. V. N. Dorr, M.I.M.M., M.I.Chem.E., has been appointed chairman of the Dorr-Oliver Co., Ltd., in place of Mr. William Russell, M.I.M.M., M.I.-Chem.E., who is retiring from that position but continuing as a director.

Dr. R. M. Barrer, D.Sc., Ph.D., F.R.I.C., has been appointed to a Readership in Chemistry in the University of London, tenable at Bedford College. Since 1939 he has been head of the chemistry department at Bradford Technical College.

Mr. J. F. Byrne, director of Paines & Byrne, Ltd., has recently returned from America where he has renewed many business contacts in connection with the manufacture of hormones, vitamins, agar, etc. Mr. Byrne speaks highly of the friendly reception extended to him and believes that considerable business, to the advantage of both countries, will result from his visit.

Dr. W. E. Cohen and Dr. A. Meller have been awarded the Grosvenor Laboratories Prize for 1945 by the Australian Chemical Institute. Dr. Cohen is principal research officer, Division of Forest Products, C.S.I.R., and Dr. Meller is research chemist with Australian Paper Manufacturers, Ltd. The award was made for contributions to the development of the paper industry.

Obituary

Mr. George Henry Joseph Adlam, O.B.E., M.A., B.Sc., who died at Wells, Somerset, on July 30, aged 70, had been editor of the *School Science Review* since its inception in 1919 and was Senior Science Master at the City of London School from 1912 until his recent retirement. His many educational textbooks on chemistry have been invaluable in promoting the welfare of school science, a cause which he served with unbounded energy and devotion.

Institute of Metals

Nomination of Officers

The undermentioned officers will retire from the Council in March, 1947, and, with the exception of the president, are not at that time eligible for re-election in their present capacities: *President*, Colonel P. G. J. Gueterbock; *Vice president*, Mr. G. L. Bailey; *Members of Council*: Sir Clive Baillieu, Mr. John Cartland, Dr. A. G. C. Gwyer, and Dr. C. Sykes.

To fill the vacancies by these retirements, the Council makes the following nominations. As *President*, Colonel P. G. J. Gueterbock, C.B., D.S.O., M.C., T.D., M.A.; as *Vice-president*, Mr. John Cartland, M.C., M.Sc., director, Fry's Metal Foundries, Ltd., and Eyre Smelting Co., Ltd.; as *Members of Council*: Professor Leslie Aitchison, B.Sc., D.Met., Dept. of Industrial Metallurgy, University of Birmingham; Mr. John Arnott, chief metallurgist, G. & J. Weir, Ltd.; Dr. Maurice Cook, delegate director and research manager, Metals Division, Imperial Chemical Industries, Ltd.; and Mr. A. J. Murphy, M.Sc., chief metallurgist, J. Stone & Co., Ltd.

Indian Mineral News

New Bureau Established

To disseminate, in non-technical language, information relating to Indian minerals and fuels, a Mineral Information Bureau is to be set up shortly in India. It will advise both on the processing and on the use of minerals, and will supply data on their availability and their quality for industrial use. It will also help industrialists by carrying out laboratory tests and by recommending technologists for prospecting, surveying, and opening up mineral deposits. The new Bureau will be under the supervision of Dr. D. N. Wadia, who will have the help of the staff of the Geological Survey of India. The Bureau's services will be provided free of charge, though small fees may be levied for special analytical work.

Quarterly Journal

A quarterly journal, entitled *Indian Minerals*, will be published, with Dr. Wadia as editor, to serve as a forum for the discussion of the mineral development of India. While the Geological Survey of India, which has recently been expanded, has maintained a small information and publications section, the new Bureau will be in a much better position to further this important aspect of the country's mineral development by satisfying the growing interest in Indian minerals, both within the country and abroad.

A CHEMIST'S BOOKSHELF

AN INTRODUCTION TO BIOCHEMISTRY. By W. R. Fearon. 3rd Ed. London: Heinemann. Pp. 569. 21s.

At a time when it is the fashion to write specialised books on certain aspects of a science it is most gratifying to find that Professor Fearon has produced a third edition of his well-known textbook *An Introduction to Biochemistry*. This new edition maintains the high reputation established by the author in this field and should serve to popularise a growing branch of chemical science.

For the benefit of those not familiar with the previous editions of this work it may be stated that the book is divided into two parts. The first consists of four short chapters, the purpose of which is to introduce the scope of biochemistry and to lay an elementary foundation of physical and inorganic chemistry, sufficient to enable the reader to follow the material in the second part, which gives an account of the various classes of organic compounds of which living material is composed and the ways in which they are metabolised and excreted.

The whole text has been thoroughly revised and the latest references to important work have been given either in the body of the text or in the very full lists of references at the end of each chapter. Although the book is modestly styled "an introduction," a student with no previous knowledge of the subject should have no difficulty in following original papers after studying the text, so lucid is the way in which the material is explained. The text throughout is well supplied with tables serving to summarise information in a most convenient way, and many diagrams illustrate various processes such as the nitrogen cycle and the relationship of the hæmoglobin derivatives. Clear diagrams such as these are more effective in getting information over than a large quantity of words, and they should be encouraged.

In addition to the general revision of the text, most of the chapters have been expanded by the insertion of new sections and a completely new chapter has been added on Tissue Chemistry, while the chapter on Tissue Respiration now devotes some space to a discussion of the energy exchanges involved in biological reactions. Other major alterations are in the chapter on Nutrients, which has been almost entirely rewritten, and it is interesting to note that at the end is a reproduction of the Recommended Dietary Allowances adopted by the Council of British Societies for Relief Abroad.

A factor which will appeal to more medically-minded readers is that greater attention has been paid to subjects which are of special interest in clinical medicine, among which may be mentioned acid-base balance, blood chemistry and bone formation. The pure organic chemist will likewise find much to interest him, and his attention will be largely centred on such subjects as the carbohydrates, steroids, amino acids, and plant pigments.

Besides the obvious value of this book to the student of biochemistry, much of the contents will be of great assistance to the analytical chemist. Various reactions are given for detecting the presence of such substances as sugars and products of excretion, and in most cases the chemistry of the test applied is explained and the limitations stated. Where a number of qualitative tests depend on the production of colours it is highly desirable that the student and the analyst should have at least some idea of how the colour is produced even if its constitution is uncertain. Some new reactions are described and these include the author's work on the use of methylamine as a reagent for lactose and maltose, and the chloroimide test for uric acid.

This new edition of a now standard work may be confidently recommended not only to the student of biochemistry for whom it is primarily designed, but as a work of reference for organic chemists in general and in particular those engaged in the food and pharmaceutical industries.

G. G. S. DUTTON.

THE SCIENCE AND ART OF PERFUMERY. By Edward Sagarin. London and New York: McGraw-Hill. Pp. 268. $3.

The author of this new and rather unusual book on perfumery is a well-known member of the American Givaudan-Delawanna concern, a fact that ensures a good deal of practical knowledge of the subject and guarantees freedom from the more elementary and familiar errors. Indeed, Mr. Sagarin freely acknowledges his indebtedness to many of his Givaudanian colleagues and additionally to Professor Marston T. Bogert, of Columbia University, Dr. P. G. Stevens, of Yale (who, incidentally, has carried out some interesting recent work on macromolecular musk-odour compounds), and Dr. Eric C. Kunz.

The Science and Art of Perfumery deals mostly with the art, craft, and æsthetics of the subject. It is well written and will undoubtedly afford instruction, entertainment, and (possibly) even inspiration to a wide audience of readers. One could particularly recommend it as "additional reading" for science students, and could readily envisage its encouraging a young B.Sc. to specialise in some branch or other of the highly developed aromatics industry.

Mr. Sagarin, in his deliberate appeal to that increasing section of the general public that likes to "get the hang of the thing" in so far as technical developments are concerned, is careful not to overdo the scien-

tific details. Yet, for all that, the word "science" in the title is amply justified, for the author neither shirks nor scamps the technology of the subject. The broad outlines are all there, deftly and accurately sketched in; and if any reader wants to pursue this or that branch of aromatics at greater length or in profuser detail, well—Mr. Sagarin has painstakingly compiled an extremely comprehensive bibliography.

I sincerely recommend this book to all who may respond to the extraordinary fascination of aromatic substances and their myriad applications. The author will take them from the most primitive uses of perfume and other historical aspects to a stimulating variety of botanical and chemical considerations, and thence to the flowers of the field and the no less fragrant odours of the laboratory. He will reveal literary and economic significances that may surprise them; and for their proper entertainment he will whisk them from age to age and from clime to clime. One chapter ("The Genealogy of a Formula") alone deserves to ensure a place for the book on many a crowded bookshelf—for in this he instructively sets out to explain the presence of each of 24 separate ingredients in a formula for Chypre perfume by the late Felix Cola.

Well done, Mr. Sagarin! Your obvious enthusiasm has proved most infectious, without in any way misleading you into hasty statements or unbalanced expressions of opinion. Knowledge, careful arrangement, wide reading and restraint: all these and other merits characterise this admirable book. I have no adverse criticisms to offer.

G. S. COLLINGRIDGE.

Industrial Safety Gleanings

Organic Silicates

ACCORDING to reports from the laboratories of Carbide and Carbon Chemicals Corp., New York, exposure to methyl silicate vapours under certain conditions of humidity, or to the liquid, may cause a necrosis of the cornea cells of the eye, which progresses long after exposure, is destructive and resistant to treatment, and may even lead to permanent blindness.

Ethyl silicate, on the other hand, has produced no serious damage to the eye, either as a vapour or even when the eyelids of test animals have been filled with the undiluted liquid. On inhalation, the ethyl silicate vapours, like those of all organic solvents, may be toxic. However, widespread industrial experience with this product has shown no evidence that it may cause silicosis or any other serious lesion.

Scientific Glassware

Government Questionnaire

AN Inter-Departmental Committee on the Scientific Instruments Industry has been formed, to deal with problems arising inside the industry. Panels have been set up within the committee to review sections of the industry. One panel has been appointed to recommend what action should be taken to encourage development, to increase production to meet the estimates of existing and potential demands at home and abroad, and, generally, to put the industry on a sound economic basis.

It is essential that this panel shall be provided with up-to-date facts on the present capacity and development plans of all firms in the industry. Accordingly, a questionnaire has been circulated asking for certain details of the production of furnace-blown, pressed, and lamp-blown scientific glassware. Firms who have not received the questionnaire are invited to communicate with the Secretary, Inter-Departmental Committee on Scientific Instruments (Scientific Glassware Panel), Room 700, Portland House, Tothill Street, London, S.W.1. All information given in the questionnaire will be treated as confidential.

Non-Ferrous Metals

Consumption during the Second Quarter

DETAILED figures of consumption of non-ferrous metals in the U.K. during the second quarter of 1946, covering zinc, lead, tin, nickel, cadmium, antimony, cobalt, and manganese, have now been issued by the Directorate of Non-Ferrous Metals. Tables are available, showing consumption of virgin metals and scrap for the various trades. Total figures, in long tons, of the consumption of virgin metal are as under:

	First Quarter 1946	*Second Quarter* 1946
Zinc ...	50,653	51,548
Lead ...	55,426	48,013
Tin ...	5421	6449
Nickel ...	2098	3094
Cadmium ...	127	138
Antimony ...	1490	1274
Cobalt ...	149	224
Manganese	136	149

Consumption of scrap metal in the second quarter, additional to the above, was as follows (in long tons): zinc, 17,559 (including remelted); lead, 29,863 (including lead refined in the U.K. from scrap and home-produced ores); tin, 1822; antimony, 754.

General News——From Week to Week

The telephone service between this country and the U.S.S.R. is now available to Kiev and Leningrad as well as to Moscow.

The resumption of exports of rosin from the U.S.A., though still on a limited scale, has brought about some improvement in the position in this country.

The London quotation for refined platinum is now £20 15s. per troy ounce. This compares with £17 previously (*see* THE CHEMICAL AGE, July 27, p. 96), and follows the recent increase in U.S. platinum prices.

The D'Arcy Exploration Company, which during the war produced from Formby over 6500 tons of crude oil, has extended its operations to Sefton, where work has begun on the drilling of land at Moss Lane, owned by Bootle Corporation.

The site at Wilton on which I.C.I. propose erecting new factories at a cost of £10,000,000, was toured last week by the chairman, Lord McGowan, who stated: "We contemplate many new developments in the chemicals line."

A trade mission from Hyderabad has arranged to build a £1,000,000 factory in India to produce rayon under the supervision of Lansil, Ltd., of Lancaster. Orders worth more than £2,000,000 have already been placed in Britain by the mission.

When fire broke out in the chemical stores at the fireworks factory of C. T. Brock & Co., Ltd., near Hemel Hempstead, last week, it soon spread to other buildings and an explosion occurred. Three men were injured. Employees fought the flames until the arrival of the fire brigades.

Members of a technical mission are shortly leaving Britain on a tour of the Caribbean oil-producing areas, mainly Trinidad, Venezuela, and Colombia, to study the mechanical equipment required in the producing fields and refineries, with a view to increasing British exports. The leader of the mission is Mr. G. R. Bolsover, a director and chief metallurgist of Samuel Fox and Co., representing United Steel Companies.

Imports of synthetic rubber have now stopped, and after October nothing but natural rubber will be used for tyres, Mr. F. D. Ascoli, chairman of the Rubber Growers' Association, stated in London last week. Meanwhile, he said, manufacturers are exhausting existing stocks of synthetic and have decided to press the Board of Trade for the return to a free market as soon as the present agreement with U.S.A. ends on December 31.

Zinc chrome is covered by Specification DTD 377A, issued by the Ministry of Supply (1s.) to supersede No. 377.

Foreign News

The Turkish Government has lifted restrictions on the export of chrome ore.

The recently nationalised chemical plants of Czechoslovakia intend establish one joint representation office in each important foreign country.

The mines of the Erzgebirge Mountains in north-western Bohemia are resuming production again, especially of copper and zinc ores.

The soap industry of Egypt has recently made such progress, it is reported, that when working at full production it can supply the whole of the requirements of Egypt.

A uranium deposit of unexplored proportions has been discovered between Ris and Châteldon, near Vichy, reports Reuter from Paris. The area is at present estimated at one to two square miles.

The Johns Manville Corporation, of America, plans to supervise the manufacture of asbestos products in ten foreign countries, including Great Britain, France, Argentina, and China.

The United Aluminium Works at Randhofen, near Braunau, Austria, built by the Germans during the war and employing 1100 people, have been placed by the American Military Administration under the trusteeship of the Austrian Government.

The production of penicillin in Germany is to be increased, especially in the Hoechst works of I.G. Farben, in order to reduce imports from abroad. It is not expected, however, that the target figure of 1000 units a month will be reached for at least two years.

France's aluminium output rose to 5678 tons in June, as compared with 5432 in May, that of 50 per cent. ferro-silicon increased from 2550 tons to 2900, while electrolytic copper production dropped from 666 to 618 tons. Output (in tons) of lead, zinc, and nickel amounted to 3452 (2039), 2689 (2784) and 84 (45) respectively.

The Allied Control Commission has approved a barter agreement between Austria and Poland which provides for the exchange of Polish coal valued at \$3,000,000, zinc valued at \$500,000, iron ore, rolled steel products, porcelain and chemical products in return for Austrian agricultural and industrial machinery and tools.

A new Belgian company, the Société Industrielle de l'Aluminium "Sidal," has been registered in Brussels with 52 million francs capital to undertake the production of and trade in metals, particularly light metals and their high-resistance alloys.

The largest German steelworks and armament combine, the Vereinigte Stahlwerke in the Ruhr, is shortly to be taken over by the British authorities, who are reported to be checking up all the foreign assets of the concern.

Polish Production of non-ferrous metals in May included 51,582 tons of zinc ore, 3202 tons of pyrites, 9510 tons of zinc concentrates, 8227 tons of sulphuric acid, 405 tons of sulphur, 4312 tons of zinc, 2131 tons of zinc sheet, 704 tons of refined lead, and nine tons of cadmium.

The directors of the Nitrate Railways of Chile announce that they have received cabled advice that another decree has been signed by the Chilean Government suspending the effects of the decree under which the Chilean State Railways were to take over the Nitrate Railways system (*see* THE CHEMICAL AGE, August 3, p. 151).

The establisment of an Office of Technical Services has been announced by the Department of Commerce in Washington. It will consist of four major units: the Invention and Engineering Division; the Industrial Research and Development Division; the Liberty and Reports Division; and the Technical Industrial Intelligence Division. The head of the new office, Mr. John C. Green, has been in England recently attending the international conference on German patents.

The final official estimate of the 1945-46 Indian linseed crop places production at 369,000 tons and the area planted at 3,376,000 acres, compared with 392,000 tons and 3,465,000 acres last year, states the Indian Trade Commissioner in London. The combined rape seed and mustard seed crop is placed at 910,000 tons and the area at 5,497,000 acres, against 1,034,000 and 5,580,000 a year ago. Crops have generally suffered from drought and the failure of the winter rains, but the condition on the whole is reported fairly good.

As a result of the commercial treaty between Belgium-Luxembourg and Holland, the following exports to Holland of chemical and allied products are provided for, according to *Le Trait d'Union Belge*. Caustic soda and bicarbonate of soda, 12,000 tons; copper sulphate, 4000 tons; sulphate of alumina, 1500 tons; and unspecified quantities of calcium chloride, barium and potassium salts, and hydrochloric acid. In addition, the export of 6000 tons of copper and its alloys, and 400 tons of "other non-ferrous metals" is provided for.

Concentration of fluorite from metals is the subject of the latest report of investigations by the U.S. Bureau of Mines (R.I. 3893). The tests showed that acid-grade fluorite was recoverable by flotation with fatty-acid collectors and further increased recovery was possible by refloating the pilot-plant tailings after thickening or desliming.

Further expansion of the American General Electric chemical department with the formation of a metallurgical division has been announced by Dr. Jeffries, general manager of the Chemical Department. Among the company's well-known products are the permanent magnet material known as Alnico (an alloy containing iron, nickel and aluminium, and generally also cobalt), and Vectolite, the first non-metallic non-conducting magnetic material ever made.

A drug that lay dormant in German laboratories throughout the war is now going into production in the United States as the most potent remedy known for the treatment of malaria, reports the *New York Journal of Commerce*. The Germans, it is stated, did not know of its anti-malarial possibilities. Chemically, it is 7-chloro-4 (4′ - diethylamino - 1′ - methylbutylamino) quinoline diphosphate. Known commercially as "Aralen," the drug is administered in tablet form, and only two tablets being required per week. It does not discolour the skin as do certain other anti-malarials.

Forthcoming Events

September 10-11. Institute of Metals (Autumn Meeting). Institution of Civil Engineers, Great George Street, London, S.W.1. September 10, 2.30 p.m.: Official business, followed by three papers. September 11, 10 a.m.: Simultaneous groups of papers (in Lecture Hall and South Reading Room); 1.15 p.m., Annual luncheon at Connaught Rooms, Great Queen Street, W.C.2. Applications to the Secretary not later than September 1.

Company News

The net trading profit of **Stream-Line Filters, Ltd.**, for the year ended December 31 last was £52,385, as compared with £29,919 for 1944. A second interim dividend of 10 per cent. makes 13 per cent. for the year (same).

At the annual meeting of **Morgan Crucible Co.** last week the chairman, Mr. P. Lindsay, announced that permission had been received to increase the ordinary capital of the company by up to £324,000 by means of an issue of new shares at a premium to be offered to the public with preferential allotment to present stockholders.

Low Temperature Carbonisation, Ltd., show a trading profit of £81,500 (£51,445) for the year ended March 31, and are paying an ordinary dividend of 6 per cent. (4 per cent.).

Reduction of the capital of **British Tar Products, Ltd.,** has now been confirmed by Mr. Justice Evershed. Repayment of 10s. for each £1 preferred ordinary and ordinary (2s. 6d. for each 5s. unit) will be made on September 7. Meetings will be held at the Mayfair Hotel on September 10, to consider cancelling the preferential rights of the £8915 preferred ordinary stock, and to convert this stock into ordinary.

New Companies Registered

E. R. G. Goffe, Ltd. (415,961).—Private company. Capital £500 in £1 shares. Manufacturers, importers and exporters of and dealers in chemicals and substitutes thereof, etc. Directors: R. G. Goffe; N. Goffe; H. G. Eggleton. Registered office: 8 Laurence Pountney Hill, E.C.4.

Silverson Machines (Sales) Ltd. (415,969).—Private company. Capital £100 in £1 shares. Dealers in and manufacturers of machines for the chemical and allied trades. Subscribers: K. J. Mallet; M. Sellars. Registered office: 11/12 Finsbury Square, E.C.2.

K. B. Products (Birmingham) Ltd. (416,165). — Private company. Capital, £1500 in £1 shares. Industrial research chemists, manufacturers and factors of polishing compounds, etc. Directors: A. E. Vellere; N. Bowen; P. S. Taylor. Registered office: Barclays Bank Chambers, South Road, Smethwick, Birmingham, 41.

Paint Removers, Ltd. (416,371).—Private company. Capital £10,000 in £1 shares. Manufacturers of and dealers in chemicals and other substances for the removal of paint, oil, grease, ink, stains and blemishes generally, etc. Subscribers: E. W. Poole; C. B. Sawkins. Secretary: E. C. Wingrove, 21 Ryder Street, St. James', S.W.1.

Britalia, Ltd. (415,900).—Private company. Capital £1000 in £1 shares. Manufacturers of and wholesale and retail dealers in chemicals, drugs, fertilisers, etc. Directors: W. O. Morgan; A. W. Anderson; J. G. Fairweather; A. H. White; P. M. Morgan. Registered office: 196 High Street, Bromley, Kent.

Anglo-American Chrome and Plating Company, Ltd. (416,033).—Private company. Capital £4000 in £1 shares. Electro-Chemical engineers. Directors: A. M. H. Van Collis; R. C. O. Reynolds; J. A. Vence-Gunstane; M. B. Collis; I. M. V. Gunstane. Registered office: Collingwood Works, Camberley, Surrey.

Fylde Laboratories, Ltd. (415,918).—Private company. Capital £4000 in £1 shares. Manufacturers of and dealers in chemicals, etc. Directors: S. Vernon; W. H. Goode. Registered office: 1 Canal Street, Deepdene, Preston.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

LAFARGE ALUMINOUS CEMENT CO., LTD., London, W. (M., 17/8/46.) July 23, £12,500 debentures, part of a series already registered. *£10,000. January 11, 1946.

Satisfactions

ACME METAL WORKS (1921), LTD., Brentford. (M.S., 17/8/46.) Satisfaction July 25, of debentures registered March 27, 1931, to the extent of £1000.

UNITED BRASS & COPPER WORKS, LTD., Hull. (M.S., 17/8/46.) Satisfaction July 25, of mortgage registered February 5, 1944.

Partnership Dissolved

E. N. LEWIS & TAYLOR (Robert Walter Cruickshank TAYLOR and Thomas Cecil VENTERS), chartered patent agents, 4 Berridge Street, Leicester. June 30, 1946.

Company Winding-Up Voluntarily

FORCE CRAG MINE, LTD. (C.W.U.V., 17/8/46.) By Extraordinary Resolution, August 2. Herbert James Rigg, of 22 Lowther Street, Carlisle, Cumberland, appointed liquidator.

Chemical and Allied Stocks and Shares

STOCK markets showed a rising trend, and although the volume of business was again only moderate, there were a number of strong industrial features. Imperial Chemical, which have been particularly active since news of the proposed £10,000,000 plant extensions, came into further prominence with a jump to 48s. 9d. (the highest level ever touched by the £1 units) attributed partly to Indian buying. Profit-taking later reduced the price to 46s. 9d.

which, however, represents a good rise on balance. Dunlop Rubber were also prominent, advancing to 78s. 9d. (before reacting to 76s. 9d.) on the prospect of a lower price for rubber next year if the proposals of the chairman of the Rubber Growers' Association for a return to a free market for the commodity are carried out.

Reflecting the general market tendency, the units of the Distillers Co. were firm at 139s., with Turner & Newall 90s., and United Molasses 54s. Borax Consolidated deferred ordinary at 47s. 6d. strengthened on the debenture conversion operation. British Aluminium were higher at 44s. 3d. on talk that there may also be a debenture conversion in this case, while Levers moved better at 53s. 9d. In other directions, Imperial Smelting at 20s. 3d. responded to hopes that the company may benefit from the new tax agreement with Australia. B. Laporte remained at 100s., Fisons were 60s., British Drug Houses 57s., Burt Boulton 26s. 3d., and Greeff Chemicals Holdings 5s. shares 13s.

Iron, coal, and steel shares remained in favour on the view that current prices, which show attractive yields, are probably undervaluations, despite nationalisation. The actual basis of compensation for shareholders in individual companies may take two years or more to be finally decided, and meanwhile the assumption in the market is that in most cases dividend payments are likely to be maintained. Only certain sections of the iron and steel industry are to be nationalised, and it is being suggested that shares of companies outside the Government's projects offer possibilities of higher dividends in due course. Elsewhere, British Oxygen have strengthened to 100s., British Plaster Board were 35s. 3d., and Associated Cement 71s. Low Temperature Carbonisation 2s. shares further improved to 3s. on the higher dividend and hopeful views of prospects of some sections of the business outside the threat of nationalisation. After an earlier rise, Triplex Glass showed a partial reaction to 42s. Shares of companies connected with plastics benefited from the better market tendency, De La Rue improving to £11¼, while British Industrial Plastics 2s. shares were 7s. 6d.

The prospect of increased demand for the company's products attracted further attention to Babcock & Wilcox, which strengthened to 64s. 6d., while International Combustion shares were £9½, and Ruston & Hornsby rallied strongly to 62s. 3d. after moving back to 61s. Dorman Long have been prominent with a further rise to 28s. Guest Keen at 39s. 3d. were again higher, as were Stewarts & Lloyds at 50s. 6d., and William Cory moved up to £5. Shipley were 36s. 3d., and Staveley 49s., while following the meeting, Thomas & Baldwins 6s. 8d. shares moved up to 11s. 3d Courtaulds and British Celanese have been active around 57s. 3d. and 37s. respectively. Among other textiles, Bradford Dyers moved up to 24s. 9d., with Fine Spinners 24s. 9d., Calico Printers 23s. 10½d., and Bleachers 14s. 7½d. also better. Boots Drug continued firm at 63s. 9d., and Sangers at 33s. 9d. remained under the influence of the higher payment. Griffiths Hughes were 60s. 6d., and Aspro shares 39s. on higher dividend talk. Beechams deferred improved to 27s. 3d. Oil shares failed to hold earlier gains, Shell easing to 93s. 9d. after 94s. 4½d., but Trinidad Leaseholds and other shares of Trinidad producers were better in response to the higher American oil prices.

British Chemical Prices

Market Reports

A MODERATE inquiry has been circulating on the London general chemical market for the majority of the industrial chemicals, and actual bookings during the week have been on a better scale than might have been expected during the early part of August. There has been a good flow of orders for shipment with a considerable volume as yet unplaced owing to supply conditions. The potash products section continues to be rather tight, with the possible exception of permanganate of potash, for which a steady inquiry is reported. There has been no change of importance in the soda products, and values remain firm. In other directions formaldehyde is a strong market, while arsenic and acetone continue to be in good call. The red and white leads are finding a ready outlet and the output of all paint raw materials is quickly absorbed. Acetic, oxalic, tartaric, and citric acid are all active on a strong demand. Very little of note can be reported among the coal-tar products, which display a firm undertone.

Manchester.—Rather busier conditions have been reported this week on the Manchester chemical market. Industrial users in Lancashire and the West Riding of Yorkshire, including the cotton and woollen textile branches, are taking fairly good deliveries under contracts, and in this respect the market has been less under the influence of seasonal conditions than it was a week ago. New inquiry on both home and export accounts has also been more in evidence. In fertiliser materials a certain amount of buying for forward delivery has been reported.

Glasgow.—Little change can be reported in the state of the Scottish heavy chemical market either for home or export trade. Considerable volume of business has been transacted during the week in all classes of chemicals. Prices show a distinct tendency to increase in nearly all grades. The demand continues to exceed supplies by a considerable margin.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Adhesives.—Ciba, Ltd. 20829-30.

Piperidyl ketones.—Ciba, Ltd. 20898-9.

Binding agents.—Ciba, Ltd. 20900.

Thioplasts.—Cie. de Produits Chimiques et Electrométallurgiques Alais, Froges et Camargue. 20920.

Dichlorethylene.—Cie. de Produits Chimiques et Electrométallurgiques Alais, Froges et Camargue. 20921.

Hydrocarbons. — Cie. Française de Raffinage. 20668-9.

Aromatic hydrocarbons.—Cie. Française de Raffinage. 20734.

Butane isomerisation.—Cie. Française de Raffinage 21169.

Dyestuffs.—J. P. Cunningham, D. Manlove, R. J. Loveluck, and I.C.I., Ltd. 20778.

Polymerisation of styrene.—Distillers Co., Ltd., G. P. Armstrong, R. R. Smith, and J. J. P. Staudinger. 20887.

Lubricating grease.—Dow Chemical Co. 21181.

Fluid-flow control valves.—E. J. Drayton. 20646.

Metal electrodeposition.—E. I. du Pont de Nemours & Co. 20465.

Polymers.—E. I. du Pont de Nemours & Co. 20878.

Interpolymers.—E. I. du Pont de Nemours & Co. 21117.

Alkoxy-substituted esters.—E. I. du Pont de Nemours & Co., and R. E. Brooks. 21123.

Insect repellents.—E. I. du Pont de Nemours & Co., and A. Dreyling. 20569.

Mono- and di-ethanolamine.—E. I du Pont de Nemours & Co., and W. F. Gresham. 21118.

Ethylamines.—E. I. du Pont de Nemours & Co., and W. F. Gresham. 21120-1.

Nitriles.—E. I. du Pont de Nemours & Co., and W. F. Gresham. 21122.

Polymers.—E. I. du Pont de Nemours & Co., and C. J. Mighton. 20571.

Bleaching cellulosic materials.—English Cellulose Derivatives, Ltd., and G. Ullmann. 20947.

Insecticides.—A. M. Ernst, and J. H. Meijers. 21187.

Magnesium.—R. Fouquet. 21134.

Dyestuffs.—D. Fysh, A. S. Gomm, J. C. Harland, and I.C.I., Ltd. 20777.

Organic compounds.—O. Gaudin. 21202.

Thiazoles.—W. N. Haworth, and L. F. Wiggins. 20721.

Penicillin salts.—Hoffman-La Roche, Inc. 21103.

Water gas.—Humphreys & Glasgow, Ltd., and I. H. Phillipps. 21188.

Light alloy bases.—G. W. Hynes. 21060.

Adhesives.—Imperial Chemical Industries, Ltd. 20876.

Metallic halides.—W. D. Jamrack, and I.C.I., Ltd. 20567.

Ammonium thiocyanates.—Koppers Co., Inc. 20642.

Ethyl naphthalene.—Koppers Co., Inc. 20643.

Treatment of coke-oven gas.—Koppers Co., Inc. 20644.

Coffee extracts.—S. A. Laboratoires Medial. 20518.

Antibiotic production.—E. Lilly & Co. 20799.

Penicillin.—E. Lilly & Co. 20987.

Cleansing, etc., agents.—J Malecki. 20989.

Synthetic resins.—Manchester Oxide Co., Ltd., V. E. Yarsley, P. Krug, and J. H. Clayton. 21075.

Liquid fuels.—G. E. Mavrodi (J. Argani). 21183.

Explosives.—G. E. Mavrodi (J. Argani). 21184.

Soaps.—G. E. Mavrodi (J. Argani). 21185.

Hormones.—Merck & Co., Inc. 21046-56.

Citric acid.—Merck & Co., Inc. 21186.

Refining of metals.—Mond Nickel Co., Ltd., A. R. Raper, and S. J. R. Fothergill. 20948.

Organic compounds.—Monsanto Chemical Co. 20598-20601. 20891.

Filtration apparatus.—Paterson Engineering Co., Ltd., and E. W. Baily. 20495.

Luminescent materials.—Philips Lamps, Ltd., and A J. Lister. 20736.

Liquid cooling apparatus.—R. Searle, F. F. Briginshaw, and A. E. Hefford. 20498.

Pigments.—F. G. Smith. 20731.

Separation of fatty oil substances.—Texaco Development Corporation. 20758.

Treatment of nylon.—Tootal Broadhurst Lee Co., Ltd., R. P. Foulds, and W. H. Roscoe. 21076.

Vitamin-containing compounds.—United Domestic Industries, Ltd., E. Kascher, and R. C. Peter. 20632.

Fluid mixing devices.—Walker, Crosweller & Co., Ltd., and C. L. Barker. 20685.

Metal derivatives.—Ward, Blenkinsop & Co., Ltd., K. T. Chapman, and P. P. Hopf. 20716.

Chemotherapeutic compositions.—Westbury Chemical Co., Inc. 20596.

Amides.—Algemeene Kunstzijde Unie N.V. 21963.

Methylol melamine products.—American Cyanamid Co. 21921-7.

Purifying glycerine.—American Cyanamid Co. 22042.

Allyl derivatives.—British Resin Products, Ltd., E. M. Evans, and H. Thurston-Hookway. 21917-8.

Resinous compositions.—British Resin Products, Ltd., E. M. Evans, and J. F. Williams. 22285.

Coating compositions.—British Resin Products, Ltd., E. M. Evans, E. M. Riley, and L. R. Anthony. 22314.

Electro-plating, etc., processes.—British Thomson-Houston Co., Ltd. 22077.

Luminescent material.—British Thomson-Houston Co., Ltd. 22190.

Charcoal.—L. J. Burrage, W. O. Whitaker, and I.C.I., Ltd. 22300.

Sulphur dioxide.—Giba, Ltd. 22094-5.

Vat dyestuffs.—Giba, Ltd. 22307-8.

Grinding of minerals.—Derbyshire Stone, Ltd., and J. W. Hobday. 22441.

Vinyl ethers.—Distillers Co., Ltd., P. L. Bramwyche, and M. Mugdan. 21919.

Polymers.—E. I. du Pont de Nemours & Co. 22035.

Polymeric materials.—E. I. du Pont de Nemours & Co. 22301-2.

Fungicidal compositions.—E. I. du Pont de Nemours & Co., W. S. Hinegardner, and J. F. Walker. 22036.

Coating materials.—E. Eckbo. 22539.

Treatment of magnesium.—C. H. R. Gower, and E. Windsor-Bowen. 22583.

Treatment of aluminium.—C. H. R. Gower, and E. Windsor-Bowen. 22584.

Amides.—R. M. Hughes (J. R. Geigy, A.-G.). 22414.

Ammonium phenoxides.—Imperial Chemical Industries, Ltd. 22304.

Coating compositions.—Imperial Chemical Industries, Ltd. (Canadian Industries, Ltd.). 22538.

Tar distillation.—International Furnace Equipment Co., Ltd., and L. Bailly. 22428.

Producer gas apparatus.—International Furnace Equipment Co., Ltd., and L. Bailly. 22429.

Pentaerythritol.—H. Jackson, K. J. C. Luckhurst, and I.C.I., Ltd. 22537.

Inks.—Lawes Bros., Ltd., L. F. W. Lawes, and C. A. Redfarn. 22377.

Penicillin.—E. Lilly & Co. 22087-8, 22144.

Liquid level measuring.—Liquidometer Corporation. 22169.

Liquid delivery apparatus.—Machinery Engineers & Designers, Ltd., A. Askey, and E. W. Burton. 22524.

Writing fluids.—H. G. Martin. 22534.

Scouring of wool.—Mathieson Alkali Works. 22417.

Chemical compounds.—Merck & Co., Inc. 21981, 22455.

Casein threads.—N.V. Onderzoekingsinstituut Research. 22278.

Purified aluminium.—National Smelting Co. 22167.

Salicylanilide preparations.—Nederlandsche Centrale Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek. 21965.

Hormones.—Nova Terapeutisk Laboratorium A/S. 22577-8.

Ion exchange processes.—Permutit Co., Ltd. 21952.

Decomposing calcium. D. Plumbridge. 22465.

Mineral, etc., washing machines.—A. Ratcliffe, G. W. Talbot, and I.C.I., Ltd. 22536.

Cellulosic products.—Rayonier, Inc. 22418.

Preparation of alloys.—Régie Nationale des Usines Renault. 22567-8.

Treatment of magnesium.—Régie Nationale des Usines Renault. 22569.

Metallic carbides.—Régie Nationale des Usines Renault. 22279.

Hard alloys.—Régie Nationale de Usines Renault. 22280-1.

Flux coated electrodes.—A. T. Roberts. 22449.

Pinacols.—Roche Products, Ltd. 22405.

Alanine.—Roche Products, Ltd. 22406.

Tertiary carbinols.—Roche Products, Ltd., A. L. Morrison, and H. Rinderknecht. 22407.

Pyridyl-3-carbinol esters. Roche Products, Ltd. (Hoffman-La Roche & Co., A.-G.). 22446.

Chemical solutions. J. D. Main Smith. 22469.

Plastic materials.—G. T. Theobald. 22473.

Metallurgy.—M. J. Udy. 22416.

Organic acid compounds. Ward Blenkinsop & Co., Ltd., and G. G. Pritchard. 22434.

Treatment of textiles.—Ward Blenkinsop & Co., Ltd., H. G. Dickenson, and P. P. Hopf. 22435-7.

Soap cooling, etc.—E. T. Webb, and Baker Perkins, Ltd. 21942.

Casting of molten substances.—Williams & Williams, Ltd., and W. D. Strachan-Smith. 21938, 22339.

Complete Specifications Open to Public Inspection

Photographic developers. General Aniline & Film Corp. January 27, 1945. 34021/45.

Colour developers comprising arylsulphon hydrazides. General Aniline & Film Corp. January 26, 1945. 1265/46.

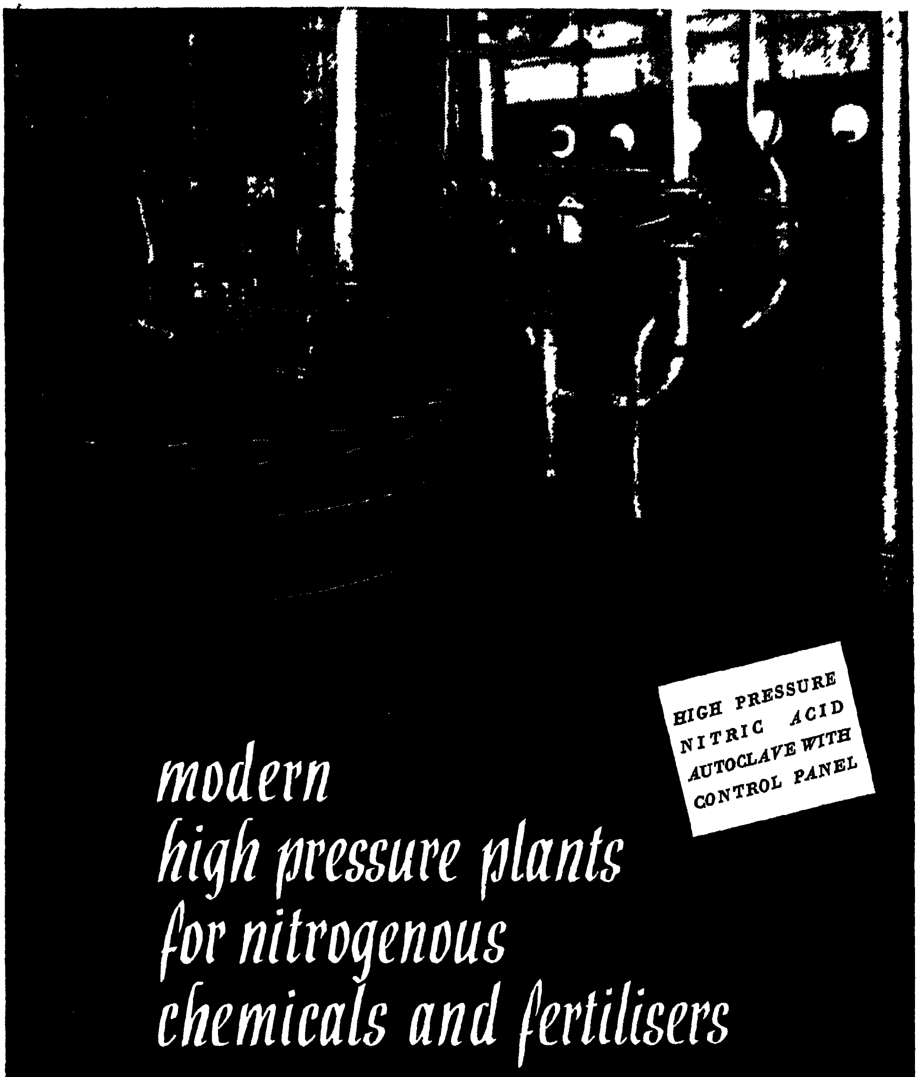
Coloured layers, especially photographic layers.—Gevaert Photo Producten N.V. May 22, 1941. (Divided out of 11280/46.) 16585/46.

Production of mono esters of ascorbic acid.—Hoffmann-La Roche, Inc. May 11, 1942. 15213/43.

Conversion of hydrocarbons.—Houdry Process Corporation. January 26, 1945. 2161/46.

Mineral glue.—J. Kemp. May 15, 1943. 19962/46.

Porous metal layers.—Mallory Metallurgical Products, Ltd. January 29, 1945. 10179/46.


HIGH PRESSURE NITRIC ACID AUTOCLAVE WITH CONTROL PANEL
modern high pressure plants for nitrogenous chemicals and fertilisers

Extraction of technically valuable products from emulsions, sludges, slurries, pulps, mashes, ground seeds and fruits and solid-water mixtures, by means of solvents. —J. W. McGregor & Sons, Ltd. January 27, 1945. 1446/46.

Extraction of wool-grease (or fats) and soap from wool scourers' liquors (or similar trade wastes) and the purification of the liquors for re-use.—J. W. McGregor & Sons, Ltd. January 27, 1945. 1447/46.

Aqueous non-alcoholic vanillin-containing flavouring composition.—Salvo Chemical Corp. January 25, 1945. 33600/45.

Electrical purification of gases.—Soc. de Purification Industrielle des Gaz. April 1, 1941. 19891/46.

Refining refractory carbides.—Soc. le Carbone-Lorraine. August 4, 1941. 19890/46.

Application of coatings of metals or metallic alloys.—Philips Lamps, Ltd. May 23, 1942. 17288/46.

Vulcanised furfuryl products.—J. B. Pierce Foundation, Inc. January 13, 1945. 34254/45.

Polymerised furfuryl alcohol plastics.—J. B. Pierce Foundation, Inc. June 13, 1945. 34255/45.

Extraction of thiophene from benzols.—Soc. des Etablissements Barbet. January 11, 1945. 19436/46.

Aluminium-silicon alloys.—Spolek pro Chemickou a Hutni Vyrobu. July 8, 1940. 17582/46.

Device for granulating molten chemicals.—Spolek pro Chemickou a Hutni Vyrobu Narodni Podnik. September 24, 1941. 17026/46.

Lubricating grease composition.—Standard Oil Development Co. December 30, 1941. 816/43.

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The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

BOUVERIE HOUSE, 154 FLEET STREET, LONDON, E.C.4

Telegrams: ALLANGAS FLEET LONDON — Telephone: CENTRAL 3212 (12 lines)

GLASGOW: 116 Hope Street (Central 3970) — BIRMINGHAM: Daimler House, Paradise Street (Midland 0784-5)

THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV
No. 1417. — August 24, 1946 — Annual Subscription 21s. Overseas 26s.

Industrial Jewels

"ART and nature thus allied, go to make a pretty bride," sang W. S Gilbert in *The Mikado*. Mankind has ever sought for precious stones for adornment. The fabulous sums that are paid for jewels of the highest quality, the skill with which Indian princes for generations past have amassed quantities of priceless stones, even the legends of death and disaster that surround certain well-known gems, all bear testimony to the high regard which human beings have for these baubles. The comparative rarity of these minerals, and the fact that they were found only in Nature and could apparently by no means be made in the laboratory, enhanced their value. There is a difference between a diamond and a glass or "paste" crystal form of the same size and shape, but it is a difference that often needs an expert eye to detect. It is easy to deceive the inexperienced by substituting a paste stone for a diamond. Why, then, is the diamond so much more highly valued as a means of adornment? That question is exceedingly difficult to answer, but the fact that it is so has caused efforts to be made to manufacture diamonds in the laboratory. If we ask, however, why the diamond is more valuable for industrial purposes than the imitation, the answer is immediately obvious. It lies in the hardness of the real mineral as compared with the comparative softness, and lack of wearing power, of the imitation article.

The diamond has resisted all efforts to manufacture synthetic stones of the same composition and quality in the laboratory. That statement may appear to be too sweeping, for it is often maintained that Hannay succeeded in 1880. His experiments were described in the *Proceedings of the Royal Society* in 1880 and 1881, and there is in existence in the Natural History Museum in South Kensington a collection of fragments which are reputed to be the artificial gems produced by him. Many deny that these are in fact Hannay's productions. The most remarkable piece of evidence that, if not of Hannay's manufacture, they had at least an unusual origin, is the fact that some of the twelve pieces in the collection possess the rare structure characteristic of the type II class of diamond; this is a mosaic, less perfect, type of structure than that of the more numerous type I diamonds. Textbooks usually give to Moissan the honour of manufacturing synthetic diamonds by melting a mixture of pure iron and carbon at 4000°C. and plunging the molten mass into water; some of the carbon was said to have been recovered in the form of boart, black

On Other Pages

diamonds used for industrial purposes, and a few microscopic transparent diamonds were also found. Not one of these diamonds has survived, unfortunately. Later experiments repeating Moissan's work have produced materials of similar appearance, which have been shown not to be diamonds. Sir Charles Parsons made many attempts to produce artificial diamonds for industrial purposes during the 1914-18 war, but to no avail. We are left with the belief that in spite of these and other claims to have produced true diamonds by laboratory methods, no one has yet succeeded in doing so and in proving that he has done so. Important as the diamond is for industry, therefore, we are still dependent upon Nature for our supplies.

The diamond is not the only industrial stone, however. Although considerably less hard (yet still possessing a hardness of 9 on Mohs' scale) certain crystalline forms of aluminium oxide are very important. These are notably the sapphire, the ruby, and corundum. There are available blue sapphires, rubies, and "white sapphires," all crystalline forms of Al_2O_3, the two former being coloured by certain impurities which have become incorporated in the crystal lattice. The hardness of these stones makes them valuable for jewelled bearings in instruments, including watches. Stones which comprise a heterogeneous assemblage of crystals are of no use for this purpose; the crystal structure must be perfect. The reliance upon Nature for industrial sapphires failed to provide sufficient jewels at a reasonable price, and science was called in to produce stones more perfect than many of those found as natural minerals. The solution of the problems of manufacturing synthetic sapphires was due to Verneuil in 1902, and his experiments have been developed into industrial processes on the Continent, notably in Germany and Switzerland.

One of our minor war-time achievements was described in a recent paper by Mr. H. P. Rooksby, of the Research Laboratories of the G.E.C. (Wembley) to the Royal Society of Arts. The objective was to manufacture perfect crystals of sapphire of adequate size. The essential point about the product was not the retention of the outward shape of the crystal, but that the structure of the molecules within should be as near perfection as possible. These experiments were successful and a British and later an American industry of considerable size was established as the result. Sapphires are also produced synthetically in Russia. Mr. Rooksby has said that no synthesis of sapphire had been attempted before 1939, but the need for sufficient jewel bearings during the war caused the Ministry of Aircraft Production to ask that manufacture should be established here, and the G.E.C. set out to rediscover the technical process of sapphire production based on Verneuil's original paper. With all Continental technical information cut off, there were many difficulties to be overcome. Complete success was achieved, however, and the British article is as good as anything made on the Continent. "From the scientist's point of view," said Mr. Rooksby, "synthetic sapphires are much to be preferred to natural stones. . . . There is much better uniformity of quality in crystals manufactured under controlled conditions."

We shall not attempt to follow Mr. Rooksby through the details which he gave to the Royal Society of Arts concerning the manufacture and use of artificial sapphires. Some brief summary of the method will, however, be of interest. The nature of the raw materials to be used is very important, and in order to obtain alumina of the correct texture and consistency, it was found necessary to fire alum crystals in silica trays in a muffle at 1000° C. for two hours. The charge swells up into a meringue-like cake consisting of γ-alumina, which is then broken down to fine powder by a tumbling process. This powder is then placed in a receptacle, of which the bottom is composed of a 40-mesh sieve, like an inverted pepper-pot. On shaking this by tapping with a hammer, powder is released downwards in a slow and controlled stream. The powder is carried in a stream of oxygen, and the gas-powder mixture flows down a vertical tube to a nozzle. On issuing from this, it meets a stream of hydrogen. An oxy-hydrogen flame is formed through which the powder must fall, and in falling through the flame it becomes heated to fusion temperature.

Verneuil's original method was based on building up the crystal from a single small nucleus and so arranging matters that no fresh nuclei could be formed. The finely-powdered alumina prepared as described was thus dropped through the flame on to a refractory support rod held between refractory walls, the powder being directed by the flame on to this rod. As the powder built up at the tip of the rod, the

flame temperature was increased (by varying the proportions of oxygen and hydrogen) to allow the deposit to spread out somewhat. Ultimately, a sort of cylinder began to form, the single crystal being thus built up very slowly by feeding the powder in small increments which are individually melted and merged with the parent crystal. Thus a succession of very thin layers are built on to the crystal. Only the top is molten in the furnace and with each increment of powder from the canister the underlying thin layer solidifies and assumes the structure and crystallographic orientation of the sapphire crystal beneath.

This ingenious method involves very slow growth. There must be sufficient time for fusion to occur and for a general merging with the underlying material to take place before the next increment can be permitted to arrive. The rate of growth cannot be accelerated beyond a certain point without spoiling the crystal structure. This maximum rate of growth is about 15 grams an hour. The rediscovery of the technology of Verneuil's process reflects the greatest credit on all concerned. We might venture to hope that the same team will now tackle the manufacture of synthetic diamonds. Art and nature have been once more allied, and the result is that not only can industrial sapphires be produced, but also sapphires that can be used as gems. Science marches on; but something of romance will have gone out of life when we can grow in the laboratory any gem we like and of almost any size we like.

NOTES AND COMMENTS

A Ministry of Science—Again!

ONCE again the suggestion has been put forward that a Department of Science should be formed, this time in America, where Mr. F. J. Curtis, chairman of the American Section of the S.C.I., recently presented the case for its establishment to the Canadian Section of the Society. We do not propose to reiterate the arguments we have often put forward against such a plan; happily in his country there seems little likelihood of its consideration, even with a Government so prone to control as are our present masters. Neither do we propose to print the arguments adduced by Mr. Curtis; they may be looked up in the issue of *Chem. Eng. News* for July 25, and we do not believe that our readers will find anything specially new or illuminating in them. We are, however, surprised to see that most valuable journal advocating the creation of a new post with Cabinet rank, in short, a Secretary of Science. It points out, somewhat naively, we feel, that the function of a Department of Science should be the furthering of science, not its control and regulation. In the name of Faraday, Liebig, and Willard Gibbs, are there no scientists in America who are capable of "furthering" their profession as much as is required? We refuse to believe it. American scientists are second to none in all departments of their profession, and we are confident that they are fully capable of regulating their business in friendly liaison with Government authorities, in the same way as their counterparts do in this country. British Government spokesmen have made it quite clear that they are generally satisfied with the present organisation of science in this country, and we have no information to the effect that scientific industry is in any way behindhand on the other side of the Atlantic.

Research Students

WRITING from the Cavendish Laboratory to *The Times*, Sir Lawrence Bragg gives encouraging figures of the number of scientific research students at Cambridge, the pre-war average of 140 having risen in the present session to 220; while in the future, it appears, this number is likely to be considerably greater. The figures quoted include the research students in the departments of physics, chemistry, and allied subjects such as metallurgy, biochemistry, and colloid science. This puts a rather different complexion on the regret expressed in the Barlow Report "that neither of the ancient universities has found it possible to suggest any permanent expansion in the student body." As Sir Lawrence Bragg points out, these research students form only a small part of the aggregate student body; but it is from this restricted field that are drawn the scientists who will lead the way in the research work of the future. The problem of scientific man-power is an important one—indeed it is among the most urgent of the day—and it is encouraging to be able to

report, on such unimpeachable authority, that Cambridge University, at any rate, is playing its full part in providing the requisite material, and this in spite of serious difficulties of staffing and accommodation.

Utilisation of Waste Products

AN interesting instance of the discovery of real value in an apparently useless waste product is recorded in a recent issue of the *Journal of the Franklin Institute*. The U.S. Department of Agriculture was seeking a useful outlet for the meal that is left over as a residue after the extraction of the oil from soya beans; and it was decided to experiment with this meal as an extender for the phenolic resin glues employed in the manufacture of plywood. First results were encouraging, but it was resolved to test the glue to see whether it would stand up to the most trying atmospheric conditions. Accordingly, at the Northern Regional Research Laboratory, Peoria, Illinois, an "accelerating weather chamber" was devised, in which the plywood. glued with the phenol-plus-soya glue, was subjected to rain and heat tests far more exacting that it was likely to meet with it exposed to normal climate. Tests up to 750 hours, embodying 375 violent changes from torrential rain to more-than-tropical sunshine, were engaged, and where panels failed under test it was because the "weather conditions" destroyed the wood, not the glue. In the most satisfactory compounding, soya meal was substituted for one-third of the more expensive phenolic resins in the glue. It is to be noted that a local plywood firm, which co-operated in the experiments, was so impressed by the results that it is now using soya meal as an extender in all its phenolic resin gluing operations.

Boilerhouse Economy

THE latest in the series of Fuel Efficiency Bulletins issued by the Ministry of Fuel and Power is entitled *The Installation and Maintenance of Boilerhouse Instruments*. The bulletin describes briefly the different forms of instruments and their function and gives general advice on the positioning of sampling points, setting up of pipe lines and installation and siting of the meters. The instruments fundamentally most important are those which act as eyes to the operator and those which enable heat balances, either partial or complete, to be constructed. The instruments dealt with are limited to feedwater and steam meters, means for fuel measuring, draught gauges, temperature measuring devices, and CO_2 indicators and recorders. The importance of following the makers' operating and maintenance instructions is stressed, particularly because in a short bulletin the very wide variety of instruments could not be covered adequately. It is believed, however, that by following the general recommendations contained in the text by far the greatest of the difficulties popularly associated with instruments will be overcome. We therefore strongly advise industrial boiler-plant users to study the bulletin, an important feature of which is that it contains a great deal of information that will be needed by those who use the boiler house log sheets that are soon to be issued by the British Standards Institution.

Discouraging the Midge

SCOTTISH manufacturing chemists indicate that there has been only a limited demand for D.M.P. midge-repellent creams of the type devised by the Scottish Tourist Board. This has been largely due to the cool conditions which have applied throughout the year. Continued experiment is, however, being made in Scotland on the habits and prevalence of midges, and the prevention of the midge pest for the correction of which the D.M.P. lotion and creams were provided. A Midge Sub-Committee of the Department of Health for Scotland has been formed to carry out detailed investigations with the aim of eliminating the pest at its source. Such detailed research appears not to have been previously undertaken, and little is known of the breeding grounds or habits of the 20 varieties of midge which are general in Britain. As soon as a midge bites, it is being trapped for identification and inspection, in a specially devised pipe. When sufficient information has been accumulated by the four university men now engaged on this work, a policy of mass prevention will be adopted to discourage the breeding and development of the pests.

According to latest reports from France, many industries have made great progress in July, thanks to the largely increased coal imports. Certain chemical products, including acetylene and liquid oxygen, now exceed the pre-war output figure by 70 per cent., while potash is up by 20 per cent. on 1939 and aluminium by 45 per cent.

Some Modern Solvents

A Summary of their Properties and Uses

by A. E. WILLIAMS, F.C.S.

WITHIN recent years many new types of solvent have been added to the already long list of those employed in industry, while other types are improvements on, or slight modifications of, well-established products. As a result of the now much wider range of varnishes, lacquers, etc., being manufactured, following upon the use of numerous synthetic resins in these products, modern solvents have found widespread employment in this sphere as well as in the textile and other industries. Most solvents can be classified as hydrocarbons—alcohols, ethers, esters, aldehydes, or ketones; the majority having as their origin either coal or petroleum. Many result from the development of the Fischer-Tropsch catalytic processes; while others are formed by hydrogenation and other methods operating on petroleum derivatives. Until the development of these processes and methods on a large industrial scale, with concomitant lowering in price of the products, the latter were obtained by the older fermentation processes. The production of solvents from acetylene is carried on extensively in districts wherein cheap electricity is available for carbide manufacture. When subjected to catalytic processes acetylene is capable of producing such solvents as ethyl alcohol, *n*-butyl alcohol, ethyl acetate, acetone, acetaldehyde, acetic acid, acetaldol, and crotonaldehyde. In some instances one solvent may be produced from another by simple chemical reactions. There are cases in which a specific substance may not be soluble in either of two particular solvents when the latter are used separately, but if the substance is acted on by a mixture of the two solvents it is readily dissolved. For example, cellulose nitrate is not appreciably soluble in either alcohol or ether, but a mixture of these two solvents dissolves it. In a similar manner, neither aliphatic higher alcohols nor aromatic ethers will dissolve nitrocellulose when acting alone, but in admixture powerful solvents are obtained for nitrocellulose.

Typical of the range of modern solvents now available in this country are those given in the following table, which is reproduced by permission of Howards & Sons, Ltd., Ilford, the manufacturers of the solvents.

Solvent	*Trade Name*	*Boiling Range, C.*	*Flash Point, °F.*	*Specific Gravity*	*Viscosity at 25° C. Centipoises*
Cyclohexane		80.5-82 (95%)	36.5	0.782	0.936
Ethyl lactate		145–160 (95%)	125	1.040	2.620
Cyclohexanone	Sextone	150–158 (95%)	117	0.950	2.200
Cyclohexanol		158–163	153	0.947	4.600
Diacetone alcohol		160–170 (92%)	130	0.943	2.907
Methylcyclohexanone	Sextone B	160–175	130	0.920	1.707
Methylcyclohexanol	Sextol	165–180	156	0.920	28.140
Cyclohexanol acetate		170–177	139	0.960	2.310
Methylcyclohexanol acetate	Sextate	172–192	143	0.942	2.360
Dipentene		175–195	140	0.850–0.860	1.540

Cyclohexane

When cyclohexanol is heated at 420°-440° C. with hydrogen under pressure, in the presence of aluminium chloride, a mixture of cyclohexane and normal hexane results. Various methods are in use for the commercial production of cyclohexane from benzene by hydrogenation. The catalyst which appears to be chiefly used is nickel, although copper has also been employed. Benzene may be quantitatively hydrogenated to cyclohexane by using an 8 per cent. nickel catalyst and a temperature of 250° C. Cyclohexane is recommended for general use in the fine chemical industry, specifically for recrystallisation purposes, for which its sharp boiling point, pleasant odour, and attractive price make it an ideal solvent. The odour of this solvent may be very easily

masked by chemicals which are recrystallised from it and by essential oils which are extracted by it. In this respect cyclohexane offers great advantages over the special petrol fractions which have hitherto been used for this purpose. This solvent is miscible in all proportions with other inorganic solvents, it is non-toxic and does not attack metals. Its rate of evaporation is approximately the same as that of benzene and it may be distilled without decomposition. Cyclohexane is less soluble in water than is petrol, also the solubility of water in this solvent is less than it is in petrol. It is an excellent solvent for oils, fats, and waxes, and it will dissolve 9 per cent. of its volume of carnauba wax, or over 20 per cent. of its volume of paraffin wax, without precipitation. As a solvent for crude rubber it is efficient, 15 per cent. solutions of pale crêpe being obtained in the cold.

Ethyl Lactate

Lactic acid is still mainly prepared by fermentation processes and, as the yield by such methods is relatively high, often 90 per cent. of the theoretical, there is not much incentive to replace these processes by other methods. From lactic acid numerous lactates are produced, some of which are used as plasticisers for cellulose derivatives and some as solvents. Ethyl lactate may be produced by passing dry HCl into a solution of lactic acid containing ethyl alcohol, allowing to stand for 24 hours, eliminating the excess hydrochloric acid, and then distilling under reduced pressure. Ethyl lactate is completely miscible with water, lacquer solvents, and diluents, including white spirit, and all other organic solvents except high-boiling petroleum hydrocarbons. It is non-inflammable, non-explosive, and non-toxic and is extremely difficult to hydrolyse with either hot or cold water.

As a solvent for nitrocellulose, cellulose acetate, and cellulose ethers it is much in demand, a 25 per cent. solution of benzylcellulose being readily prepared in the cold. Both natural and synthetic resins—*e.g.*, shellac, copals, phenols, glyptals, urea-formaldehyde, vinyls—are readily dissolved by it, and it is one of the best solvents for the basic dyes used in lacquers. This solvent has a dilution ratio of 6.25 with respect to toluene and 5.75 to xylene. Such ratios can be used in practice, since ethyl lactate evaporates much more slowly than either of these diluents, so that the dilution ratios are not upset in the drying lacquer films. A mixture of 1 part ethyl lactate with 4 parts high-flash naphtha is very useful for high-flash nitrocellulose lacquers. Ethyl lactate is very stable even in the presence of alkaline pigments, etc., and of resins and oils of high acidity, provided that moisture is not present to any appreciable extent. Lacquers containing this solvent and alkaline pigments have been stored in tins for over 8 months without deterioration or hydrolysis. Ethyl lactate finds extensive employment in the preparation of synthetic resin lacquers, both of the air-drying and stoving types, thanks to its high solvent power for many of those resins, the low viscosity of the solutions obtained and its suitable evaporation rate.

The range of solvents for cellulose acetate is comparatively small, while the majority of them have the disadvantages of being very inflammable or toxic, and they are nearly all of the 'low-boiler" type. Hence, as solvents for cellulose acetate, such products as cyclohexanone, diacetone alcohol, and ethyl lactate have big advantages, for they possess suitably graded evaporation rates, they prevent the too rapid drying of a film, and in this way avoid the dangers of blushing and uneven flow. The dilution ratios of ethyl lactate with cellulose acetate are considerably higher than those of any other solvent. In the manufacture of fast coating colour finishes for leather, ethyl lactate is used extensively, and it is widely employed in the manufacture of leathercloth, artificial leathers, and special types of linoleum. In this direction ethyl lactate gives excellent flowing out and penetration, the films so formed having good polishing surfaces and adhesion. This solvent has been found useful in the preparation of cellulose acetate and other powder mouldings and plastics, and also the celluloid types. It is used in French polishes, wherein it is effective in preventing "chilling." The textile industries employ it in printing with indigosols, basic, acid, direct, and chrome colours, as a solvent for the dye, and for relustring acetate rayon. Because of its high solvent power for resin, oils and other ingredients of printing inks—and the fact that it is entirely water-free—it is used in the printing industry for the cleaning of type, blocks, offset blankets, rollers, and other delicate printing equipment.

Cyclohexanone

Cyclohexanone is obtained in admixture with cyclohexanol by the hydrogenation, under pressure, of aromatic hydrocarbons in the presence of nickel or copper catalysts. The raw materials used may be phenol, toluene, or xylene, while the temperatures employed may range between 140° and 200° C. It is a colourless liquid with a ketonic odour, its solubility in water being about 5 per cent. The anhydrous solvent distils without decomposition and can be steam-distilled quantitatively from all its mixtures. With most lacquer solvents and other organic solvents it is miscible, while it does not attack metals, is non-inflammable and non-toxic. For nitrocellulose it is a good solvent, and in nitrocellulose lacquers it is used as a solvent of

the "medium-boiler" type, this term referring to relative rate of evaporation. Cyclohexanone is an excellent solvent for cellulose acetate, and when used as a solvent for cellulose ethers gives low viscosity solutions, dissolving from two to three times as much as most other solvents.

In the varnish industry and in others wherein a powerful solvent for resins—both natural and synthetic—is required, it is largely used for shellac, copals, ester gum, coumarone, phenol- and urea-formaldehyde resins, glyptals, polystyrenes, polyvinyls, cyclohexanone resin, maleic resins, and the like. In the preparation of spraying, brushing, and dipping lacquers it finds wide employment. Its rate of evaporation produces lacquers having good flow, and it gives clear, smooth, glossy, tough, and strongly adhesive films. Lacquers containing it have strong blush resistance, which renders unnecessary the addition of any other anti-blush material, such as butyl alcohol or high-boiling esters. When used in a spraying lacquer its normal evaporation rate can be considerably increased by the addition of low-boiling diluents, since it has a very high dilution ratio for coal-tar hydrocarbons.

High Dilution Ratio

To toluene and xylene it has a dilution ratio of 7.25 and to benzene 6.25, higher than those of any other lacquer solvent. Such ratios are quite workable in practice because cyclohexanone evaporates much more slowly than these diluents or their mixtures, so that the dilution ratios are not upset in the drying lacquer films. This combination of high solvent power with high dilution ratio enables a considerably higher percentage of nitrocellulose to be kept in a lacquer than when weaker solvents are used. In the blending of nitrocellulose and resins in lacquers cyclohexanone is specially effective, requiring no further addition of any other resin solvent. A special feature of this solvent is that it is applicable to both spirit-soluble and hydrocarbon-soluble resins, as also to the preparation of "combination" lacquers containing nitrocellulose and such oils as linseed and tung.

In the creation of light and fancy leathers, leather coats and gloves, cyclohexanone is considered by the industry to be one of the best thinners for the fast coating colour finishes used therein. It is used as a direct solvent of the "medium-boiler" type in cellulose acetate lacquers and dopes, for which purpose it imparts similar properties to the films and has otherwise the same advantages as ethyl lactate. Because of its special evaporation rate and capacity for dissolving nitrocellulose and oils it is used extensively in the manufacture of leather cloth, artificial leathers, and some types of linoleum. In a variety of industries this solvent is much in demand for the degreasing of metals, wherein it has the advantage of being non-inflammable, non-toxic, and non-corrosive. Thanks to its high solvent power for shellac, cellulose esters, and basic dyes, cyclohexanone is used in the preparation of printing and marking inks. At slightly elevated temperatures, such as 50°C., it is a good solvent for crude rubber, and at this temperature 20 per cent. solutions of pale crêpe can be obtained within a few hours; while it also produces cellulose lacquers having excellent adhesion to rubber surfaces.

Cyclohexanol and Methylcyclohexanol

Cyclohexanol, or hexahydrophenol, results from the hydrogenation of pure phenol. Methylcyclohexanol is a product of the hydrogenation of the various cresols, using nickel as a catalyst, and temperatures between 180° and 220°C. Both cyclohexanol and its methyl derivative are particularly suitable for incorporation in soaps and preparations of the sulphonated-oil, hydrocarbon, and fatty-alcohol types, for several reasons. In the first place they have remarkable solvent, wetting-out and emulsion-stabilising properties. Secondly, they are high-boiling, non-inflammable and non-toxic alcohols, which are very stable and, therefore, cause neither corrosion of plant or containers, nor decomposition of soaps. Finally, they are easily incorporated in soaps of all kinds, producing soaps giving clear solutions with water. Soaps containing either of these solvents have greater detergent powers and higher solubilities than soaps not containing such solvents. The Rideal-Walker coefficient of methylcyclohexanol is 1.5, and soaps in which it is incorporated possess marked insecticidal and germicidal properties without being toxic. Both in this country and abroad these two solvents are now widely employed in the manufacture of all types of soap.

They are also good solvents for several classes of dye, such as basic, chrome, some acid, and the majority of the acetate rayon dyes. In many printing and dyeing operations wherein the above classes of dye are involved, they are widely used, because of their high solvent, dispersing, and penetrating powers, good stability, and suitable volatility. They are of assistance in penetration with vat colours. Although they are not direct solvents for nitrocellulose, in the presence of esters or ketones they form good solvent mixtures for it, while at fairly high temperatures they have a softening action on it. Neither of these solvents has any action on cellulose acetate at ordinary temperatures, but they have a slight gelling action on it at temperatures between 90° and 100°C., and a somewhat stronger action between 100° and 110°C. Both of them are good solvents for cellulose ethers, and in nitrocellulose lacquers they are employed as

"high-boiling" alcohols, retarding evaporation and preventing blushing, for which purpose they are most effective, but care should be taken that they are not used when only "low-boiling" solvents are present. In synthetic resin lacquers of the stoving type both these solvents find employment because of their high solvent powers for synthetic resins and their suitable evaporation rates.

To reduce the viscosity of oil varnishes a small percentage of methylcyclohexanol may be used, particularly with very quick-drying wood oil varnishes, resulting in appreciable economy in thinners. It reduces "false body," giving complete and homogeneous solutions and, even when after running, the copals are not compatible with the polymerised wood oil—as sometimes happens—the addition of methylcyclohexanol will clarify the varnish. The same applies to wood oil and copal esters. To prevent skinning in both oil- and synthetic-resin varnishes the addition of a small proportion of methylcyclohexanol is most effective; and for this purpose, in general, it is better—as well as cheaper—than some other solvents. Methylcyclohexanol is used in the form of a liquid soap—containing a fairly high percentage of the solvent—for cleaning all types of paint work. This solvent is also employed in degreasing leather, either in the dry solvent degreasing process—in which it is mixed with the petrol, etc., or in the aqueous soap degreasing process, wherein it is used either dissolved in the soap solution or in the form of a methylcyclohexanol soap. These two solvents find employment in the preparation of boot, furniture, and metal polishes, because of their high solvent power for waxes and stabilising power for wax emulsions, combined with a strong detergent action. They are used for the production of homogeneous liquid mixtures of hydrocarbons and alcohols or ketones. Cyclohexanol has been proved successful in preventing oxidation in lubricating oils and in increasing the oiliness of oils for high-pressure, low-speed bearings.

Diacetone Alcohol

This alcohol is one of the many derivatives now obtainable from petroleum, by way of propylene and acetone. Diacetone alcohol is miscible in all proportions with water, the usual lacquer solvents, and all other organic solvents except white spirit—with which it is only partially miscible—and high-boiling petroleum hydrocarbons, in which it is entirely immiscible. Alkalis decompose it at room temperatures and acids decompose it at temperatures above 100° C. It is an excellent solvent for nitrocellulose, with a solvent action slightly quicker than that of methylcyclohexanol acetate, while it is a fairly good solvent for cellulose acetate and cellulose ethers. This alcohol is used as a solvent of the high-boiler type in nitrocellulose lacquers, and it is useful for the formulation of brushing lacquers, since its rate of evaporation is low, so that it allows ample time for brushing without unduly delaying the drying of the lacquer. It has a dilution ratio of 3.25 with respect to toluene, 2.75 to benzene, and 2.0 to xylene.

In synthetic resin lacquers of the stoving type diacetone alcohol is used because of its suitable evaporation rate combined with its high solvent power, specifically for the urea resins. It is used as a direct solvent of the high-boiler type in cellulose acetate lacquers, and dopes, and in the preparation of acetate film. Its dilution ratios with cellulose acetate are higher than those of any other solvent except ethyl lactate. In the textile trades diacetone alcohol is used in printing with basic, acid, chrome, and direct colours, as a solvent for the dye. In printing-inks it is widely employed, and owing to its very high solvent power for shellac and dyes it is used in spirit and watergravure inks, while its evaporation rate makes it useful as a high-boiling solvent for cellulose inks. This alcohol is a good solvent for bitumen, but it has no action on rubber.

Methylcyclohexanone

Obtained by the methylation of cyclohexanone, this product is a good solvent for cellulose ethers, nitrocellulose, gums, and resins, including synthetic products like polyvinyl chloride and polystyrene. Furthermore, the addition of a small percentage to other solvents will markedly accelerate solution of nitrocellulose and resins. It is used as a solvent of the medium-boiler type in nitrocellulose lacquers, and it has excellent solvent power for basic dyes, wherein its good wetting properties appreciably aid solution. The dilution ratios of methylcyclohexanone are 5.5 to toluene and benzene, 7.0 to xylene, and 1.25 to white spirit or turpentine substitute. Even higher dilution ratios are obtained with toluol-methylated spirit mixtures, a dilution of 12 volumes with an equal-parts mixture having been obtained, having a final concentration of 10 per cent. nitrocellulose. Methylcyclohexanone is much cheaper than cyclohexanone, but both these solvents have the property of enabling a higher gloss to be obtained in films laid down from them than is attainable with any other solvent. Incidentally, they are the only solvents which will blend nitrocellulose and coumarone or indene resins in lacquers.

Methylcyclohexanone is used in cellulose acetate lacquers and dopes as a high-boiling solvent for preventing blushing, also as a high-boiler in all types of spirit varnish, wherein it improves flow and brushing properties, on account of its efficiency as a gum solvent. It is likewise employed with plastics and moulding-powders of the cellulose ester and ether and synthetic resin types.

A small percentage is sufficient to reduce the viscosity of oil varnishes, which makes for great economy in thinners, especially in the case of very quick-drying wood oil varnishes. In common with cyclohexanone, it is a good solvent for bitumen, and in bituminous compositions; in those containing cellulose esters, ethers, or oils, it is extensively used to reduce the viscosity and to give better flow, brushing, and gloss. Its solvent power for crude rubber is somewhat lower than that of cyclohexanone, but it is an excellent solvent for chlorinated rubber, and is normally used in small proportions in conjunction with the cheaper hydrocarbons This solvent tolerates the addition of far greater quantities of white spirit to chlorinated rubber solutions than does any other solvent. For example, a mixture of 1 part methylcyclohexanone by volume and 6 parts white spirit will give a 10 per cent. solution of extra high viscosity chlorinated rubber.

Cyclohexanol Acetate

Cyclohexanol acetate is miscible in all proportions with the usual lacquer solvents, diluents, etc., is insoluble in water, and distils without decomposition. While it is a good solvent for nitrocellulose it is a little slower in action in this connecton than is cyclohexanone. Its rate of evaporation resembles that of ethyl lactate. It is a powerful solvent for many resins—both natural and synthetic—including dammar, copals, ester gums, urea-formaldehyde, glyptals, polyvinyls, polystyrene, cyclohexanone resin, maleic resins, etc. As a solvent of the medium-boiler type it is used in nitrocellulose lacquers, and it is employed both in spraying and in brushing lacquers, wherein it produces good blush resistance, excellent flow, and films having a high gloss. With toluene it has a dilution ratio of 2.5, the figures for xylene and white spirit being 3.0 and 1.5 respectively. Its high flash-point is a decided asset in many compositions, while its efficient blending power, combined with suitable evaporation rate, makes it one of the most useful solvents for preventing and removing "gum blush." Cyclohexanol acetate is a suitable solvent for blending nitrocellulose, linseed- and tung-oils in combination lacquers. It is also a good solvent for fats, oils (fixed, mineral, and essential), and waxes.

Solvent for Waxes

A typical example of its solvent power for waxes is shown by the fact that it completely dissolves 12 per cent. of its volume of carnauba wax without precipitation. It is a tolerably good solvent for bitumen, but in this respect cyclohexanone and methylcyclohexanone are better. The solvent action of cyclohexanol acetate on crude rubber is considerably quicker than that of cyclohexanone. In the cold, rubber is dissolved only slowly, but the action is greatly accelerated on heating to about 50° C., and at this temperature 20 per cent. solutions of pale crêpe are obtained in a few hours. In the rubber industry this solvent has an advantage over many others used in that it is both non-inflammable and non-toxic.

Methylcyclohexanone Acetate

This solvent may be a mixture of the three isomeric acetates. It is insoluble in water, distils without decomposition, is miscible in all proportions with the usual lacquer solvents and diluents, and also with all other organic solvents. It is non-inflammable, non-explosive, non-toxic and, in general, is used in the same industries as cyclohexanol acetate. Its solvent action on rubber is slightly slower than that of cyclohexanol acetate. This solvent gives smooth, homogeneous, glossy films when used in spraying and brushing lacquers, and produces products with a high resistance to blushing under very humid conditions. It is a very effective solvent for blending nitrocellulose and resins, and also for blending nitrocellulose with linseed- and tung-oils in combination lacquers, while it is also used in synthetic resin lacquers of the stoving type. It has a dilution ratio of 2.25 with respect to toluene and xylene, 2.0 to benzene, and the comparatively high ratio of 1.5 with white spirit. Its solvent power for oils, fats, and waxes, and for bitumen, is excellent.

Dipentene

Dipentene may be obtained from various natural sources; it may also be prepared from pinene or camphene, or by heating terpineol with potassium hydrogen sulphate. It is a solvent which can usefully replace turpentine or white spirit in all types of oil varnishes and synthetic resin finishes, in which its solvent properties ensure good flow and prevention of skinning. For chlorinated rubber it is useful as its mild solvent action does not cause lifting of the undercoat. It finds extensive employment in the manufacture of wax floor and furniture polishes, replacing turpentine or white spirit. As an anti-frothing agent it is used in textile printing and, partly on account of its pleasant odour, it is widely utilised in disinfectant preparations.

The growing need for reliable and economical pumps in the chemical industry brings many interesting and often difficult problems with it, chief of which is the employment of materials which are not attacked by the liquids delivered. Some of the solutions found for such problems by Sulzer Bros. (London), Ltd., 31 Bedford Square, London, W.C.1, are described in No. 3 of *Sulzer Technical Review*.

LETTER TO THE EDITOR

B.A.C. and T.U.C.

SIR,—I have read your "Notes and Comments" on the ballot which the British Association of Chemists is taking on the question of affiliation with the T.U.C., and I feel that in some ways it tends to mislead anyone not familiar with the private discussions that have taken place inside the Association. It would certainly mislead some who may be considering joining the British Association of Chemists.

In the first place I think it should be made clear to your readers that the resolution upon which members were asked to vote was *not* the Council's motion. During the last few years there has been so much argument among members for and against affiliation to the T.U.C. that the Council decided that the matter ought to be settled one way or the other as quickly as possible. They decided to consult the members by calling a general meeting and by taking a ballot, and the Executive Committee were instructed to proceed with the arrangements.

One of the members of the Executive Committee, Mr. D. Jackson, happened to be a strong supporter of affiliation, and he was asked to propose the resolution in favour of affiliation at the general meeting. I happened to be in the chair at the general meeting and I made it clear that Mr. Jackson would not speak on behalf of the Executive Committee, but would express his own opinion. Those were my words. The Council are under no delusions regarding the political activities of the T.U.C., but they realise that there are some reasons why affiliation might be an advantage to some members.

Government Departments like to negotiatiate with large bodies representing groups of workers or a group of manufacturers. Every day I find that I can negotiate with a department as chairman of a trade association on a matter which they would not discuss officially with a private firm. Similarly, some of the larger firms in the chemical industry like to negotiate with employees who are properly regimented in unions and affiliations of unions, and in this way they compel bodies like the B.A.C. to consider how far they should go in this direction in their efforts to help all their members.

My own view is that affiliation need have none of the ill effects which you visualise, but at the same time I believe that it would label the Association as a supporter of a certain political party. That, I believe, to be very bad indeed, not because it would be true, but because it would prevent large numbers of chemists from joining the B.A.C.

A very strong association along the lines of the B.A.C. is needed. All chemists should be members whether they are employees or managing directors of companies, professors of chemistry, or teachers in schools. There are many reasons why this is becoming increasingly necessary, and the State schemes of social security add to the urgent need for co-operative effort to maintain and improve the position of professional men.

Many trade unionists are not socialists, and in theory it is possible for the T.U.C. to be run by members of the Conservative and Liberal parties. If chemists wish to belong to a trade union which is definitely a supporter of the Socialist party they can probably find one which they can join, but it is not the B.A.C. We have among our members active representatives of all parties and we plan to build an organisation which can benefit the profession as a whole and not a particular section who work for political ends.—Your faithfully,

NORMAN SHELDON,
Vice-President & Vice-Chairman of Council of the British Association of Chemists.

London, W.1.
August 19.

Fluorene and Fluoranthene

A Simple Synthesis

PASSAGE of 2-methylbiphenyl in the vapour phase at 500° C. over a palladium catalyst results in its conversion to fluorene. The conversion can be made nearly quantitative by recycling the unchanged starting material, and this reaction provides a simple, new method of obtaining synthetic fluorene.

In the synthesis of fluoranthene by means of the "cyclodehydrogenation reaction" starting material is obtained from the Grignard condensation of 1-naphthylmagnesium bromide with cyclohexanone. The carbinol which results from this reaction is dehydrated to 1-(tetrahydrophenyl)-naphthalene. When this compound was treated with a palladium catalyst at 500° C. it was converted to fluoranthene. A catalyst composed of 12 per cent. chromia on alumina is better than palladium in the reaction.

It is of interest to note that fluorene and fluoranthene occur in large quantities in the tar from coal carbonisation. The cyclodehydrogenation reaction not only helps to explain the occurrence of many polynuclear compounds in coal tar, but opens up new methods for obtaining in a simple fashion various pure synthetic polynuclear compounds. (From a paper by Orchin and Reggel before the American Chemical Society; from *Chem. Met. Eng.*, 1946, 53, No. 7, p. 264).

New Foamslag Slab Factory

Glasgow Corporation's Experiment

A FOAMSLAG slab precasting plant was opened at Tollcross, Glasgow, on August 9, under the auspices of the Glasgow Corporation. The project was planned in 1939, when the research department of the Glasgow Housing Department became interested in the possibilities of precasting foamslag slabs for building. Following various experiments full approval was given to the project, although actual authority to build did not mature till August, 1944.

Foamslag is a cellular lightweight aggregate produced by the combined treatment of inflating and chilling molten blast furnace slag, of suitable chemical composition, at a temperature of approximately 1400° C. The raw material is treated with water by a patented apparatus and the molten slag inflated or "foamed" to from seven to ten times its original volume. The cells so formed are sealed or self-contained and when the slag is cast the same characteristics apply, the sealed pores remaining inert and not decomposing. This makes foamslag a suitable material for housing; it dries quickly, is incombustible, and is chemically identical with granulated slag, which forms the basis of Portland blast-furnace cement. It is light in weight in relation to its bulk, has excellent insulating qualities, and is also useful in that it has nailholding qualities to an extent not possessed by other such materials.

Design and Lay-Out

This factory is probably the only direct-flow precast foamslag slab plant in this country and has been specially designed to meet the requirements of Glasgow Corporation. It consists of a single-storey building 270 ft. long by 170 ft. wide with a floor space of 30,000 sq. ft. It has two identical units separated by a central line, the only common facility being the boiler house. A second storey in the rear of the building carries the mixing plant.

The plant being in duplicate, the following details cover one half-section, an exact replica completing the whole. The dominating feature of the plant is the elevating gear at the side. This consists of a boom scraper which operates with a semicircular movement, dragging aggregate from the storage bins (in the open) to a hopper, from which they are elevated (still externally) in a bucket elevator to a point above the mixing plant. The material is fed by gravity into storage hoppers, which retain the aggregate under control until required. Cement is meanwhile brought in from a store in the rear of the plant, carried on an overhead runway by cradle to a loading bank, and tipped into a floor hopper, through which a worm operates to carry the cement to a shaft. A bucket elevator working in this shaft carries the cement to a storage point above the mixers. Water is stored in a 10,000-gallon storage tank behind the plant.

Description of Process

All the ingredients are controlled at the mixing point by careful gearing of the delivery feeds to the pace of the mixer belt. The mixer is a special type A.B.C. automatic belt controlled with a maximum capacity of 30 cu. yds. per hour. Delivery feeds can be adjusted to give the precise volume required, while the stoppage of any one delivery would automatically halt the entire process. It is thus impossible for the mixer to fail to deliver an incorrect mix after the controls have been set to a given constitution of mix. The mix when processed is fed to the moulds on the ground floor. These moulds consist of steel frames with steel mesh and specially designed locking clips. Reinforcement, spot welded on the premises, is inserted before pouring, one moulding bay being used entirely for wall slabs. The largest of these is 10 ft. by 8 ft. 8 in. by 6 in. thick. The other bay, in the adjoining section, is used for wall angles, etc.

Moulds and slabs, etc., are moved, throughout the entire plant, by a system of overhead runways and travelling cranes. At the milling point the moulds are lowered on to a floor roller conveyor section for easy and steady handling, and then hoisted by pendant chains. Automatic stops and locking gear ensure the correct alignment of the hand overhead transporter cranes with the hand runways, the whole offering a smooth easy system of transport to any point in the plant.

Moulds are taken to a battery of eight curing ovens, lying centrally throughout the plant, four to each mixing and filling unit. Internal walls are of foamslag slabs and doors are steel, specially sealed. Each oven will carry about 30-40 slabs, which are processed by wet and dry steam at about 130 lb./sq. in. pressure for 24 hours before emerging adequately cooked. The wet steam is carried in a central floor-duct with outlets at 4 ft. 6 in. centres, while the dry heat is provided by a bank of pipes on one wall of each oven. On emerging, the slabs in their moulds are transferred to the dismantling section. Here, at the delivery end of the plant, the steel moulds are lowered, and the clips undone; the slab is then secured and carried out of its mould to the storage racks. The mould is reassembled

and transported back to the filling point for further use.

The storage racks, partly in the open, consist of a series of steel racks against which the slabs are either rested or clipped. Loading bays among the racks facilitate easy handling of the slabs for loading, the work being done entirely by mechanical means. In the transport from the storage yard to the site, similar special plans have had to be made. A low trailer with twin steel racks has been devised to carry eight slabs, which are loaded in a semi-erect position and clipped to the racks by specially designed clips.

The plant has welding shops for the prefabrication of the reinforced rod and additional storage accommodation for the accumulation of slag aggregate. The entire layout is mechanically excellent, much of the equipment and components in use having been designed specially for the plant. It follows the smoothest possible theory of straight flow operation, and should achieve the desired output, stated a year ago to be an annual capacity of 2000 houses. So far the plant has been delayed by lack of materials and by other difficulties, and its 1946 output has yet to be determined. Cost of construction is not indicated, and estimates vary from £30,000 to £150,000. The mechanical handling facilities and directness of operation may well be envied by older plants where conditions and space prevent the adoption of such straightforward methods.

Oilseed Production

Mission to West Africa

TO investigate and report, in conjunction with the Colonial Governments concerned, the possibilities of increasing an exportable surplus of vegetable oils and oilseeds, and to recommend means of securing maximum production, including transport facilities—these are the terms of reference of the mission which the Colonial Secretary, Mr. George Hall, has decided to send to West Africa.

Chairman of the mission is Dr. B. A. Keen, D.Sc., F.R.S., assistant director of Rothamsted Experimental Station; the members are Mr. J. McFadyen, director of the English and Scottish Joint Co-operative Wholesale Societies, and Mr. C. E. Rooke, C.M.G., formerly general manager of the Nigerian Railways. They left by air for Nigeria on August 19. That colony is the immediate field of investigation, and the question of visiting other West African territories will be decided in the light of information gleaned during the tour, which will cover the groundnut-growing area around Kane, in the North, and the palm nut belt in the eastern province.

Technical Steel Mission

Visits to Caribbean Oilfields

FURTHER news has now been received about what is believed to be the first purely technical mission ever to leave this country. It will shortly make a three-months' tour of the oilfields and refineries in Trinidad, Venezuela, and Colombia (*see* THE CHEMICAL AGE, August 17, p. 209). An invitation to visit the oilfields was extended by one of the petroleum companies to The United Steel Companies, Ltd., who have long been engaged in special research work for the production of steels to resist the many difficult conditions existing in the drilling and refining of petroleum. Further consideration showed that problems other than metallurgical might be encountered during such a visit and convinced the company that the mission would more correctly be made representative of other interested industries. Accordingly, member firms of the Council of British Manufacturers of Petroleum Equipment were approached and their co-operation was readily forthcoming. While all the members of the present mission are members of the Council, the mission is purely a private one organised and financed by the members themselves.

An American Monopoly

It is well known that before the war this valuable business was almost entirely an American monopoly and equipment to the value of many millions of pounds is purchased annually by the oil companies. The importance of the visit, therefore, cannot be too greatly stressed, since its successful conclusion must have far-reaching results on our export trade. Every support is being accorded the mission by the Ministry of Fuel and Power and the Export Development Department of the Board of Trade, and on arrival in Trinidad a public reception will be held by the Governor General. The President of Venezuela has also expressed a wish to receive the members.

Members of the Mission

The mission, as already reported, is under the leadership of Mr. G. R. Bolsover, director and chief metallurgist of Samuel Fox & Co., Ltd. (branch of the United Steel Companies, Ltd.), and comprises the following: Messrs. E. E. Allen (Industrial & Engineering Development Assn.); D. H. Carter (Head Wrightson Processes, Ltd.); A. G. Ellison (Yorkshire Copper Works); F. T. Forestier (Newman, Hender & Co., Ltd.); E. F. E. Howard (Hayward, Tyler & Co., Ltd., also representing other firms); F. Kenyon (Wm. Kenyon & Sons, Ltd.); H. Martin (Murex Welding Processes, Ltd.); E. Pritchard (British Oilfields Equipment Co.); and G. H. Thorne (Dawnays, Ltd.).

Fluorine Production in the U.S.

Opportunity for New Processes

NOTED for its pioneering activities in the development of fluorine chemicals in America, the Pennsylvania Salt Company has again set the pace with its pilot-plant production of pure elemental fluorine. The process employed has been described in *Chem. Met. Eng.* (1946, *53*, No. 7, p 106), by Richard W. Porter, and an abridgement of his account follows hereunder.

Following their successful production of anhydrous hydrofluoric acid (A.H.F.) in 1931, the company, conveniently known as "Pennsalt," proceeded with experimental methods of manufacturing elemental fluorine, having decided that the electrochemical method was the only practical way in which this element can be produced. Now, after several years, "Pennsalt" has evolved an electrolytic cell which has been operated successfully for some time in the production of high-purity fluorine; and this pilot-plant cell seems to meet the requirements for economic commercial production.

Capable of producing several pounds of fluorine daily, the cell consists essentially of a rectangular jacketed vessel of welded steel (Fig. 1), with an airtight removable cover. From the cover are suspended two anodes of carbon, two steel cathodes, and a steel gas barrier. A standard grade of corrosion-resisting low-carbon steel is used throughout. Carbon is the only satisfactory anode material; nickel anodes suffer excessive corrosion, while graphite disintegrates rapidly.

Anodes and gas barrier are insulated from each other and also from the cathode which is electrically connected to the cell body. The barrier, a sheet steel skirt, surrounds the anodes and extends below the surface of the electrolyte to keep separate the products of electrolysis. Anolyte and catholyte mix freely in the cell, no diaphragm being necessary.

Operating normally at 9-10 volts and 250 amp., the cell can handle a fairly high overload. Current efficiency is well over 90 per cent. However, large electrode overvoltages, as well as electrolytic resistance, reduce the aggregate power efficiency to a low value. The energy requirement calculated for the cell reaction, $2HF \rightarrow H_2 + F_2$, would be equivalent to a theoretical voltage considerably lower than the 9-10 V. observed.

The electrolyte is made up of a solution

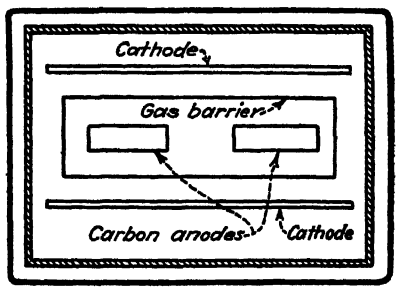
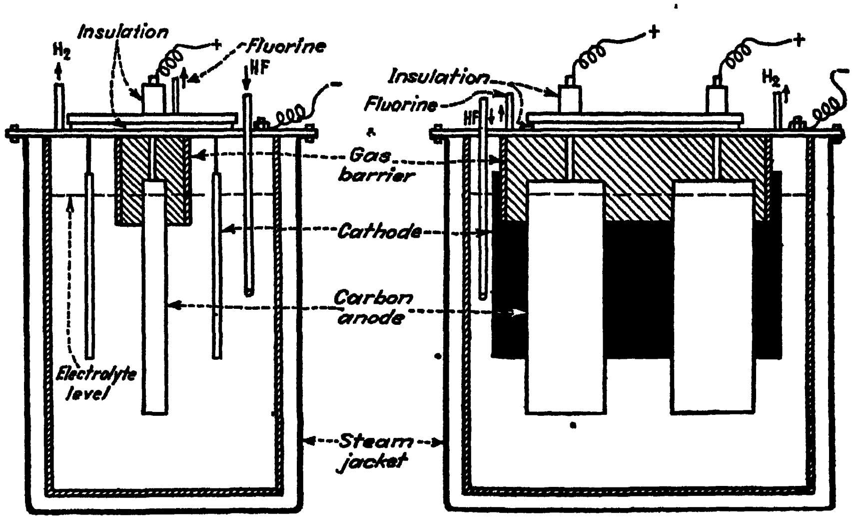


Fig. 1. Schematic diagrams illustrating the "Pennsalt" electrolytic fluorine c ll (*Chem. Met. Eng.*).



of A.H.F. in fused potassium bifluoride, with 40 per cent. A.H.F. by weight. Solid KHF_2 charged into the cell is heated to about 95° C. by steam in the cell jacket, but it remains solid until the addition of A.H.F. lowers the melting-point of the mixture. At the concentration used, the m.p. is 72° C.

When electrolysis begins, HF dissociates to form fluorine gas at the anode and hydrogen at the cathode. Kept separate by the barrier, these products are discharged continuously. As the electrolyte is depleted of hydrogen and fluoride ions, it is regenerated, either continuously or intermittently, by addition of A.H.F.

Both the fluorine and hydrogen contain about 5 per cent. by weight of HF and less than 1 per cent. of other impurities. These may be comprised of atmospheric gases and, to a lesser degree, of fluorine oxide formed from traces of moisture which may enter with the HF feed. Carbon tetrafluoride does not seem to be present in any significant quantity. Fluorine is purified by removing the HF either by absorbing it in sodium fluoride or by chilling. After purification the fluorine gas is used directly or is compressed and filled in special cylinders for storing and shipping. For some applications, such as direct fluorination of hydrocarbons, HF is not an objectionable impurity and the cell gas may be used without purification. The cathode product, hydrogen, is discarded but in commercial operation the HF would be recovered.

Critical Temperatures

Cady (*J.A.C.S.*, 1934, *56*, 1431) has shown that there are three regions of temperature and HF concentration suitable for electrolysis to produce fluorine. In each of these regions the system is liquid and the vapour pressure within practical limits. Excess HF loss occurs if this exceeds 5 cm. Hg.

The low-temperature region, used by Moissan, has the disadvantage of requiring below $-30°$ C. which is hard to maintain; here also it appears necessary to use noble metal electrodes. The high-temperature region is reported to have been used on a commercial scale in Germany during the war. A temperature of about 250° C. is necessary and close control is required, since the permissible range of composition and temperature must be held within narrow limits. In this case, however, it is possible to use graphite anodes which have better electrical and mechanical properties than carbon.

Commercially, the region in the middle temperature range (95°-100° C.) is considered to have the best characteristics and is the one used by Pennsalt. Operating temperature is convenient to maintain and less rigid control is required because of the fairly wide range of composition and temperature in which it is possible to operate.

Perhaps the most important process variable is composition of the electrolyte. It is controlled by addition of A.H.F. using liquid level as a guide with an occasional check by chemical analysis. Since only HF is consumed, it is the only variable which will cause changes in liquid level. A.H.F. is thus added to the melt at a rate necessary to compensate for dissociation. Rapid absorption of the A.H.F. in the melt occurs and thorough mixing is aided by the gas lift at the electrodes. No other agitation is required.

Electrolyte composition is maintained at 38-40 per cent. A.H.F. This is important. If the concentraton of HF is allowed to rise, the vapour pressure increases, causing undue loss of HF, in both the fluorine and hydrogen. On the other hand, if the concentration of HF is low, the melting-point of the electrolyte may rise to the temperature at which solidification begins.

Another critical factor in cell operation is temperature. While the cell will operate within fairly wide temperature limits it is desirable to control it rather closely to attain uniform, efficient operation. Here the temperature is held in the neighbourhood of 95° C. Although at the start of operation the cell must be heated to fuse the electrolyte, once electrolysis has begun sufficient heat is generated to require cooling of the cell by circulating water through the cell jacket instead of steam.

Actually, the exact temperature of operation for a particular cell design depends on a number of factors. Again, it is a question of economics. Generally, a higher temperature is desirable from the standpoint of cell efficiency. This increases conductivity so that a lower voltage may be used and less power consumed. Conversely, however, higher temperatures increase the vapour pressure of the electrolyte, causing increased evaporation of HF with consequent loss.

Impurities

Relatively pure raw materials are necessary to ensure uniform operation and a high-purity product. Moisture, in particular, causes difficulty because it electrolyses to form O_2 or F_2O, and may also contribute to the "anode effect." Tentative raw material specifications which have proved satisfactory at Pennsalt are given herewith.

The following maximum percentages of impurities in KHF_2 are permitted: K_2SiF_6, 0.2; SO_3, 0.1; Cl, 0.05; H_2O, 0.05 per cent.; maximum loss in 1 hr. at 100° C. Even more important is the purity of A.H.F. Since this is consumed by electrolysis, concentration of impurities may build up in the electrolyte. Maximum percentages of allowable impurities are as follows: H_2SiF_6, 0.1; SO_2, 0.06; H_2SO_4, 0.004; H_2O, 0.2.

A common difficulty in many electrochemical operations employing fused salt electro-

lytes is also observed in the fluorine cell. The "anode effect" or "polarisation" as it is often called, results from the spread of a film of fluorine gas over the surface of the carbon anode, which prevents the anode from functioning. It causes a sudden increase in cell voltage and a decrease in cell current. This phenomenon is not wholly understood but appears to be correlated with a critical range of moisture content in the electrolyte. The "anode effect" is most serious in an intermittent operation, but where a cell operates continuously, using a strictly anhydrous grade of electrolyte, it is of little consequence. When the "anode effect" does occur, it may be overcome by temporary substitution of a nickel anode for the carbon anode.

The gas barrier, which normally "floats" in an electrically neutral condition between anode and cathode, must be checked frequently against insulation failure by measuring the voltage between it and each of the electrodes. If the insulation between barrier and cathode fails, the steel barrier acts as a cathode, with the result that hydrogen may be generated in the fluorine zone, causing the two liberated gases to recombine explosively. Severe corrosion may occur if the insulation between barrier and the anode should fail.

Under proper conditions, operation of the fluorine cell is smooth and safe. Faulty operation, however, may cause explosions of varying degrees of intensity. Thus, the failure of the cathode-barrier insulation, as noted above, may produce a continuous crackling sound as the gases recombine. Excess back-pressure in the fluorine line may force the gas beneath the barrier into the hydrogen zone, producing heavy, rumbling explosions. The most severe explosions will result from leakage of air into the hydrogen zone and ignition of the mixture by stray bubbles of fluorine. To prevent damage to the cell in the event of unusually severe explosion, emergency plugs are installed in the cell cover to relieve excess pressure.

Materials of Construction

Fluorine can be handled at atmospheric or moderately elevated temperatures in several metals with little or no corrosion. These include iron (low carbon steel), copper, magnesium, nickel, and Monel. In these materials, an adherent fluoride film appears to give the necessary protection to the metal surface. The gas is piped in steel or copper, but valve seats and stems, where abrasion occurs, are preferably made of Monel. Certain plastics have been found valuable as packing and gasket material. Carbon anodes are not noticeably eroded by the electrolysis, but sometimes fail by cracking or splitting. Graphite and nickel anodes are unsatisfactory.

One of the major problems was that of developing suitable containers for storing and shipping fluorine. Steel cylinders with a special valve-packing material were finally adopted. These contain about ½ lb. of fluorine at 400 lb./sq. in. in pressure. Purified gas is compressed into the cylinders behind a ½-ton steel barrier through which the operation is remotely controlled. This barrier is fitted with a sight window of 2-in. thick bullet-proof glass covered on the inside with Plexiglass to prevent the glass from etching. The reason for this precaution is to protect the operator from direct impact of any possible explosions.

Further precautions are taken to ensure safety of the fluorine cylinders in transit. They are stored for a period of a few weeks at a temperature of 130°F., during which time the pressure of each cylinder is checked at intervals. This betrays any cylinder leakage which might cause trouble and endanger personnel during handling.

New Products

Availability of fluorine may be expected to intensify the research in the field of fluorine compounds that has been going on steadily over the past few years.

Many promising new products are still in the development stage. One of these is an organic fluoride liquid (a highly fluorinated hydrocarbon) non-inflammable and non-toxic, with a high enough boiling point and specific gravity to replace mercury in the present mercury vapour boiler. Another is a gas, sulphur hexafluoride, already developed but requiring elemental fluorine to manufacture, said to be a more nearly perfect insulator than is at present available for high voltages used in X-ray and nuclear physics work. Other developments include a highly stable synthetic lubricating oil, insecticides, anæsthetics, solvents, fireproofing materials, resins, and plastics.

BRITISH INDUSTRIES FAIR

The first British Industries Fair since 1939 is to be held from May 5 to 16 next year at Earls Court and Olympia, London, and at Castle Bromwich, Birmingham. As in pre-war years, exhibits will be grouped in two main sections, the lighter industries in London and the engineering and hardware at Birmingham. The London section of the Fair is organised by the Export Promotion Department, Board of Trade, 35 Old Queen Street, London, S.W.1, and the engineering and hardware section by the Birmingham Chamber of Commerce, 95 New Street, Birmingham, 2. Special attention will be devoted to the display of United Kingdom products suitable for export and it is hoped the Fair will attract many buyers from abroad as well as buyers in Britain. Application forms for space are now being sent to manufacturers.

German Technical Reports

Latest Publications

SOME of the latest technical reports from the Intelligence Committees in Germany are detailed below. Copies are obtainable from H.M. Stationery Office at the prices stated. The current list includes reports from the Joint Intelligence Operations Agency (JIOA).

CIOS XXXII—58. *Chemical compositions of German pyrotechnic smoke signals* (3s.).

CIOS XXXII—68. *Manufacture and application of lubricants* (4s. 6d.).

CIOS XXXII—119. *Ruhr and Salzgitter Area*: Iron and steel industry. (12s. 6d.).

BIOS 257. *Metallgesellschaft A.G., Frankfurt*: Chemicals for phosphating iron and steel (1s.).

BIOS 328. *Antimony smelting industry* (3s.).

BIOS 441. *Platinum metals industry* (6s.).

BIOS 522. *I.G. Farben A.G., Höchst*: The de-ashing of coal by combined jig washing, froth-flotation and extraction with caustic soda (2s.).

BIOS 524. *Deutsche Gasolin A.G., Hamburg*: Lubricants (4s. 6d.).

BIOS 531. *Steel drum industry* (9s.).

BIOS 541. *Some German methods of grading and surface coating of abrasives* (1s. 6d.).

BIOS 554. *Ampoule and vial-making machines*: improvements and developments (1s. 6d.).

BIOS 560. *I.G. Farben Fabrik, Wolfen*: Distillation of phenols (1s.).

BIOS 562. *Phosphorus industry at Bitterfeld and Piesteritz* (6s. 6d.).

BIOS 522. *Interrogation of Dr. Lochfert, Rhenania Phosphat Werke, Brunsbuttelkoog* (1s.).

FIAT 67. *Chemical developments and applications in the synthetics industry.* (6s. 6d.).

FIAT 144. *I.G. Farben, Dormagen*: Acetic acid recovery, aceto-butyric acid recovery, propionic acid recovery (1s.).

FIAT 229. *Copper, lead, zinc, tin, and antimony smelting and refining in North-Western Germany* (4s. 6d.).

FIAT 239. *Hoesch Benzin, A.G., Dortmund*: Fischer-Tropsch plant (6d.).

FIAT 276. *Kaiser Wilhelm Institut fur Kohlenforschung, Mülheim, Ruhr*: Interrogation of Dr. Helmuth Pichler and Professor Karl Ziegler. Information concerning "Isosynthesis." Comparative experiments with iron catalysts (1s. 6d.).

FIAT 293. *I.G. Farben, Leverkusen*: Information on recoil fluid used by German Army; synthetic lubricating oils from tetrahydrofuran; additive for break-in oil (1s. 6d.).

FIAT 408. *Dr. Ing. A. Thau, Didier Werke A.G., Berlin*: *Metallurgical coke* (9s. 6d.).

FIAT 500. *Design of acetylene cylinder filling plants*, 1945 (1s. 6d.).

FIAT 511. *Acetylene generator designs*, 1945 (2s. 6d.).

FIAT 513. *I.G. Farben, Hoechst*: Study of hydrogen and methane production from coke oven gas (5s. 6d.).

FIAT 528. *Light-sensitive reproduction materials* (7s. 6d.).

FIAT 531. *Roechling'sche Stahlwerke Voelkingen, Saar*: Study of metallurgical coke—developments in methods of production and testing (11s. 6d.).

FIAT 577. *Survey of the leading manufacturers of pressure vessels* (4s. 6d.).

FIAT 712. *Desmodur R.*: Manufacturing process of a synthetic adhesive (1s.).

FIAT 801. *Industrial safety* (13s. 6d.).

JIOA 23. *Recovery of vanadium from iron and steel plant slags* (1s.).

JIOA 28. *Air-foam fire-fighting equipment* (21s.)

JIOA 34. *Chemical fire extinguishers* (9s.).

JIOA 40. *Oil refineries* (5s. 6d.).

New I.C.I. Laboratories

Fundamental Research in Industry

IMPERIAL Chemical Industries have leased the house and laboratories at The Frythe, Welwyn, Herts, for long-term general and academic research in branches of biological, chemical and physical science. Among the subjects to be studied are the antibiotic products of moulds, kinetics of continuous chemical reactions, and the deformation of materials under high stresses of short duration. Work will also be done on the design of industrial instruments and on industrial toxicology.

The new laboratories will eventually house twenty or more senior research workers, with assistants and administrative staff. Some of the staff have already been recruited, but have hitherto been scattered in various localities while engaged on war-work.

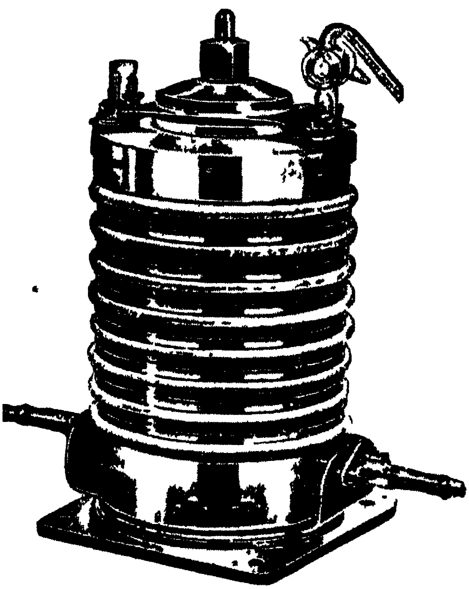
The premises at The Frythe are intended as temporary accommodation until a site at Butterwick Wood, near St. Albans, which was originally selected, can be developed. The activities of the Butterwick Research Laboratories will be completely independent of all other I.C.I. research departments, which will continue to be concerned with more specifically industrial problems.

Laboratory Equipment

New Items of Interest

FROM A. Gallenkamp & Co., Ltd., 17-29 Sun Street, Finsbury Square, E.C.2, we have received copies of recent publications describing new laboratory equipment, some of which is of particular interest.

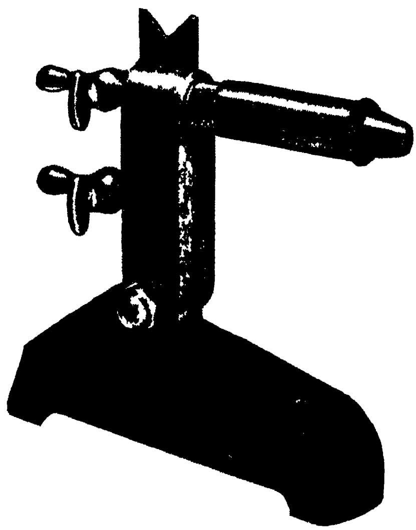
There is, for instance, the "P.G. 14" filter press, which has been designed for the filtration of chemical, bacteriological, and pharmaceutical products where it is essential to ensure the utmost cleanliness, sterility, and immunity from attack of corrosive liquids, or metallic contamination of the liquids. The filter is thus made of Hysil glass throughout, with the exception of the



The "P.G.14" laboratory filter press.

stainless steel clamping bolts, which do not come into contact with the liquid that is being filtered. The passage of liquid through the filter can be watched and its condition observed. The loss of valuable liquids is obviated by the completeness of draining at the end of a run, this being made possible by the vertical working position of the filter and the design of the channels. The lower portion of the filter can be used for clarifying and the upper portion for sterilising by means of a transfer plate, which makes a useful accessory.

Among a wide range of glassblowers' tools is a new "Gallenkamp" blowpipe, which replaces the previous model. It is a simple, powerful burner, capable of giving a variety of flames suited to all operations in general laboratory glassblowing. The burner tubes and fittings are finished in bright nickel plate. A grey enamelled casting of pleasing and stable shape forms the base, while the



The new "Gallenkamp" laboratory-pattern blowpipe.

stand is a polished aluminium alloy die casting, with a U-notch for cutting and shaping glass. With the blowpipe are supplied three interchangeable jets.

Other new equipment includes electric ovens of advanced design and electrically heated tube furnaces.

Fisons' Expansion Plans

Negotiations with Genatosan.

THE chairman of Genatosan, Ltd., announces that negotiations are proceeding with Fisons, Ltd., by which the latter company will make an offer of equivalent to 12s. 6d. per share for the whole of Genatosan's outstanding 1s. ordinary shares. Fisons already hold a controlling interest in the other company.

In a review of the current year, the chairman of Fisons, Mr. F. G. Clavering Fison, reported that his company would undertake expenditure of not less than £3,000,000, to be spread over a period of three years. As already reported, a new factory is to be erected at Immingham, with a capacity of 100,000 tons per annum, and work has been started at Avonmouth to permit of an additional annual capacity of 75,000 tons. Among the products to be turned out at Immingham is triple superphosphate, not hitherto manufactured in this country.

New Control Orders

Exemptions from Key Industry Duty

THE Treasury has made an Order (S. R. & O. 1946, No. 1340), which became effective on August 14, exempting the following from Key Industry Duty until December 31, 1946.

Analysers and polarisers consisting of a film of polarising material mounted between glass discs or plates. Fermentographs for measuring and recording carbon dioxide evolved during dough fermentation; integrators (planimeter type). Sealed cylindrical X-ray tubes having two or four windows.

Celtium oxide; dysprosium oxide; erbium oxide; europium oxide; gadolinium oxide; holmium oxide; lutecium oxide; scandium compounds; terbium oxide; thulium oxide; ytterbium oxide.

Acetamidosalol (acetylamido phenol salicylate); acid adipinic; R. acid carbolic; acid carbolic (synthetic); acid dipropylmalonic; acid filicic; acid maleic; acid propionic; acid succinic, but *not* acid *iso*succinic (acid methyl-malonic).

Acid *iso*butyl allyl barbituric; acid *iso* propyl barbituric; *iso*-amyl ethyl barbituric acid; *N*-methyl ethyl phenyl malonyl urea; sodium ethyl methyl butyl barbiturate; sodium *iso*-amyl ethyl barbiturate.

Alcohol amido-ethyl; alcohol dodecyl (alcohol duodecyl); alcohol isopropyl, unrefined, containing not less than 0.5 per cent. by weight of ketones. Alcohol propylene; allyl paracetamino-phenol; amido-guanidine sulphate; amidopyrin (dimethyl-amidoantipyrine); amidopyrin-barbitone; R. benzophenol; benzophenol (synthetic). Butyl methyl adipate; camphene; carbamide; caesium bromide; ethyl cellulose; cocaine, crude; pseudo-cumenol.

Crystals, not optically worked, weighing not less than 2.5 grams each, consisting wholly of one of the following: barium bromide; R. barium chloride; barium fluoride; barium iodide; caesium chloride, caesium iodide; calcium bromide; R. calcium chloride; R. calcium fluoride; calcium iodide; lithium bromide; lithium chloride; lithium fluoride; lithium iodide; R. magnesium oxide; potassium bromide; R. potassium chloride; potassium fluoride; potassium iodide; rubidium bromide; rubidium chloride; rubidium fluoride; rubidium iodide; sodium bromide; R. sodium chloride; sodium fluoride; sodium iodide.

Methyl cyclohexanol methyl adipate; dicyandiamide; didial (ethyl morphine diallyl barbiturate); *p*-di-ethoxy ethenyl diphenylamidine and its hydrochloride; diethyl amino-ethanol; diethylamine; diphenyl; diphenyl oxide; elbon (cinnamoyl para-oxyphenyl-urea); emetine; emetine bismuth iodide; emetine hydrobromate; emetine hydrochlorate; ethyl abietate; hydrogenated ethyl abietate; ethyl benzoyl-benzoate; Eukodal; furfural; germanium oxide.

Diglyceryl tetra-acetate; glycol ethers; guanidin carbonate; guanidin nitrate; guanidine sulphate; guanidin sulphocyanide; Kryofin; lipoidin; maleic anhydride; R. mannite (R. mannitol); menthyl ethyl glycollate *N*-(oxy - aceto - mercuric - propyl)-ethylurethane; methyl amidoxy-benzoate.

Hydrogenated methyl abietate; methyl abietate; oxymethyl *para*-oxyphenyl benzylamine methyl sulphate; methyl-sulphonal (diethylsulphonemethylethylmethane, trional); methylene chloride; α-naphthyl *iso*thiocyanate; nickel hydroxide. Sodium diacetyl sulpho-succinate.

Copper methyl arsenate; 4-oxy-3--ethylamino-phenyl arsinic acid; *N*-methyl tetrahydro-pyridine β-carboxylic acid methyl ester; oxy-acetophenone, *meta-*; phenetidine, *ortho-*; phenetidyl--phenacetin and its hydrochloride; phenol (synthetic), R. phenol; phytin; piperazine (diethylene-diamine, Dispermin); potassium ethyl xanthogenate (potassium xanthogenate); potassium guaiacol sulphonate; R. potassium hydroxide (R. potassium caustic, R. potassium hydrate); safrol; sodium phenyl dimethyl pyrazolone amino-methane sulphonate; sulphonal; theophylline; urea; veratrine; xylol, *meta;* xylol, *para.*

Vanadium-silica compounds specially prepared for use as catalysts for sulphuric acid manufacture.

Soya Flour

The Soya Flour (Control and Maximum Prices) Order, 1946 (S. R. & O. 1946, No. 1344) replacing the corresponding 1943 Order, came into force on August 11. By this Order the maximum price of soya flour on a sale of 28 lb. or more is increased from £33 5s. to £52 5s. per ton, and on a sale of less than 28 lb. from 5d. to 7½d. a lb. The prepacking of soya flour except under licence is prohibited.

Protective Clothing

An amendment (S. R. & O. 1946, No. 1379) of the General Licence S. R. & O., 1944. No. 802, operative from August 16, makes the following additions to the list of persons who may sign type "K" coupon-equivalent certificates for the provision of protective clothing: A person authorised by the Ministry of Health or by the Board of Trade; the Clerk to the Council of the Chartered Society of Physiotherapy; the Registrar of the Board of Registration of Medical Auxiliaries; the Secretary of the British Medical Association; the Hon. Secretary of the Northern Ireland District Dental War Committee; the General Secretary of the Institution of British Launderers; and the Secretary, Registrar or Bursar of a University or University College in Great Britain in receipt of a Treasury Grant.

Personal Notes

MR. H. C. D. LOCK has been appointed an additional director of British Glues & Chemicals, Ltd.

MR. ROBERT FOOT, chairman of the Mining Association, has joined Powell Duffryn as a managing director, replacing Lord Hyndley.

MR. K. W. L. KENCHINGTON, Woolwich Arsenal, and MR. G. E. C. WATTS, Colne, Lancs, were successful in the Textile Institute's recent examination in the Analysis and Testing of Textile Materials.

MR. C. BELKNAP, chairman of the board of the Monsanto Chemical Company, St. Louis, U.S.A., is retiring on October 1 to become vice-chancellor of Washington University, St. Louis.

MR. H. L. DERBY, president of the American Cyanamid and Chemical Corporation, has resigned from all activities connected with that concern. He has also retired from the presidency of the Manufacturing Chemists' Association of America, being succeeded in that office by MR. C. S. MUNSON, of U.S. Industrial Chemicals.

MR. SAMUEL COURTAULD, who will complete 25 years as chairman of Courtaulds, Ltd., on October 24, is to relinquish his chairmanship on that date, on grounds of health, though he will remain a member of the board. MR. J. C. HANBURY-WILLIAMS has been elected to succeed Mr. Courtauld as chairman, and on assuming that office will relinquish his managing directorship.

MR. THOMAS PENNY, a member of Lever Brothers' board, Port Sunlight, since 1940, has been appointed chairman of Joseph Watson & Sons, Ltd., Leeds, taking over at the end of the year. He will be succeeded as technical director of Lever Brothers, Port Sunlight, by MR. J. P. BRIERLEY, at present technical director of the Lever Brothers Co., Canada.

The director of the National Paint Federation announces the appointment of MAJOR JOHN BAXTER as Statistical Officer with the Federation. This is the first appointment to be made under the scheme for the reorganisation of the Federation's Secretariat. Major Baxter is at present employed with the Scottish Special Housing Association, Edinburgh. He takes up his new duties with the Federation on September 2.

DR. CHARLES A. H. WRIGHT has been elected president of the Chemical Institute of Canada, in succession to Dr. R. R. McLaughlin, the first president. Dr. Wright is consulting chemical engineer of the Consolidated Mining and Smelting Co., Ltd., whose lead and zinc works at Trail, British Columbia, are the largest non-ferrous metallurgical plant in the world. Dr. Wright was the first engineering graduate of the University of British Columbia. He took the Ph.D. degree at McGill and studied for a year as Ramsay Memorial Fellow at University College, London. He has been with Consolidated Mining and Smelting since 1925, but he maintains also an interest in academic affairs, being a member of the Senate of the University of British Columbia.

Obituary

MR. ROBERT HENRY CLAYTON, a director of the associated companies of Hardman & Holden, Ltd., and Manchester Oxide Co., Ltd., died at his home in Didsbury, Manchester, on August 12 at the age of 74. Mr. Clayton had been connected with these companies for over 50 years and had been a director for 43 years. He was also a director of the Cortonwood Collieries Co., Ltd. He was actively interested in the affairs of Manchester University, being a member of the Court of Governors and a past chairman of Convocation. Mr. Clayton was a prominent member of the Manchester Literary and Philosophical Society of which he was president from 1937-1939 and treasurer for many years.

Scottish Seaweed Industry

Discouraging Labour Situation

DESPITE considerable encouragement, and high wages and prices, seaweed gathering and processing in the West of Scotland is progressing slowly because of acute shortage of labour. There is at the same time a considerable labour potential in the islands, the position being that the islanders show a definite reluctance to work to modern commercial requirements. Difficulty has been experienced in obtaining all the seaweed required to work to capacity, and imported seaweed from Ireland is actually being used to feed the plant established in South Uist. This winter mechanical methods of harvesting will be employed, harrows drawn by tractors being used to collect the weed from the shore, and conveyor belts to deliver it to the plant. The seaweed is sun-dried and then kiln-dried before being broken, crushed, and milled. Plans for a modern plant capable of drying 200 tons per day have been meantime delayed because of the difficulty of obtaining an adequate flow of the required raw material. Islanders are paid £3 5s. per ton dry and £2 per ton wet seaweed, and in a short season can earn substantial sums. The real trouble is that the development of modern industry is not regarded with favour and that, with the exception of a limited group of island workers, the average islander is not disposed to encourage the invasion by non-islanders.

A CHEMIST'S BOOKSHELF

ORGANIC QUALITATIVE MICROANALYSIS. By Frank Schneider. London: Chapman and Hall. Pp. 218. 21s.

Readers in this country will undoubtedly be somewhat startled by the statement, in the introduction to this book, that although the value of organic [qualitative] analysis as a method of instruction in organic chemistry has long been realised, many colleges and universities have hesitated to offer such courses because of the expense and space required. This statement, it may be explained, refers to the United States. In the reviewer's experience, at least, a major part of organic practical instruction in this country is concerned with the methods of qualitative analysis and the procedures arising from these methods. British chemists will need no special pleading to convince them of the worth of such teaching.

That micro methods, so far unaccountably neglected in this branch, as Dr. Schneider remarks, should be developed, is a logical outcome of present-day trends, which have led to the widespread introduction of, for example, inorganic qualitative small-scale methods. A student using the methods would learn much about the theory of organic chemistry, he would not lose any valuable technique, since he would undoubtedly continue to carry out a reasonable selection of synthesis on the full scale; and he would save time and material. The practising analytical chemist, also, would find the small-scale methods as reliable as the large-scale, and would gain in speed and convenience. Consequently, the appearance of Dr. Schneider's book, based on his well-known published papers in this field, of which he has been one of the pioneers, has been looked forward to with some eagerness.

The reviewer must confess, after studying the book, to a feeling of some disappointment. This is not because it is a poor book; it is anything but that. It is because the whole of the book does not reach the high standard of some of its parts.

Some detailed examination of the aim of the book, in conjunction with its achievement, is called for. On the jacket it is claimed that we have, within the book, "complete and detailed instructions for the preparation, isolation, purification, and identification of very small quantities of organic compounds." However, we find, in fact, that the book must be used in conjunction with one or other of several listed standard works on the identification of organic compounds. Without such aid, unless the worker had already a sound knowledge of organic chemistry, and could read between the lines with some ingenuity, it is doubtful whether he could *identify* a single organic compound.

The opening chapter, on general methods, will be valuable to those unacquainted with microchemical technique. This is followed by a lengthy section on purification of the sample. This section provides an excellent collection of micro methods—distillation, crystallisation and other organic operations. It is very fully and clearly illustrated, and useful references are given. But it is much too uncritical. One feels very strongly that the author, who must have tried most of the methods described, should be able to give more specific guidance from his experience.

The chapter on the detection of elements is well done, although the reviewer is not convinced that the simplest methods are described. This, however, is a matter for debate, and it is not proposed as an adverse criticism. In the section dealing with the determination of physical properties we are once more presented with too great a wealth of material. It would have been preferable to describe fewer methods if some clearer indication of reliability and convenience were given.

It is in the latter half of the book that the reviewer finds the greatest pleasure, and, paradoxically, the greatest disappointment, since it is from this stage that the worker will have to proceed with two text-books on his bench. This portion of the book deals with the classification of compounds into groups by micro tests, and the preparation of appropriate derivatives. If this were combined with tables giving the determinable values for a selection of compounds, however small, then the book would have fulfilled its function. But apart from a few isolated tables, not readily available, this is not done. Thus, it is possible for the worker to identify a compound as, say, a ketone. With this, lacking another reference book, he must be content.

The descriptions of the tests, and the directions for syntheses are admirably clear, and they alone would make the book invaluable. It is to be hoped that the later groups, containing compounds "of higher orders," will ultimately be dealt with in the same intensive fashion as the compounds of carbon, hydrogen, and oxygen. The inclusion, too, of some halogen compounds under compounds containing nitrogen may, failing further explanation, be confusing.

If the reviewer seems to have dealt unduly hardly with this book, it is because he feels so warmly concerning the need for a book such as this purports to be. The present work has got well on the way to fulfilling the need. There is no other book which gives half the information contained here. There is, indeed, no other book known to the reviewer in the same field, and it is palatably presented. In future editions it is to be anticipated that Dr. Schneider will present us with a true chemical classic.

CECIL L. WILSON.

General News—From Week to Week

Telephone service has been reopened with Chile, Paraguay, Peru and Uruguay and will be available between 2 p.m. and 8 p.m. every afternoon.

The City Library, Brunswick Road, Gloucester, has been added to the list of public libraries at which intelligence reports on German industry may be consulted.

The season of extension courses at Manchester University starts on August 26 with a fortnight's advanced course in physical chemistry by Professor M. Polanyi and others.

Zinc naphthenate is covered by a new specification D.T.D. No. 759 (6d.); revised specifications dealing with magnesium alloy castings are Nos. 136B, 281A, 289A (1s. each), superseding 136A, 281 and 289.

A new factory for the manufacture of conveyor belting is to be erected by Turner Bros. Asbestos, Ltd., at Hindley, in the S. Lancashire development area. About 900 persons will be employed in it.

The Scientific Film Society has arranged to show every month a programme of scientific and documentary films. Performances will be at the Scala Theatre, London, W.1, and will be given on Sunday afternoons and evenings, beginning in September.

Work started this month in the new factory of the East Anglia Chemical Co., Ltd., Aycliffe Trading Estate, Darlington, operations having been transferred from Nuneaton without a hitch. The move was necessitated by a considerable expansion in the company's production of lacquers and plastics.

The North of England Institute of Mining and Mechanical Engineers, Neville Hall, Newcastle-upon-Tyne, is anxious to bring its collection of safety lamps up to date as far as possible. The council will be grateful to receive from members (or others) any lamps in their possession for inspection and cataloguing. Any lamps received that are already in the Institute's collection will be returned to their owners.

A limited number of permanent commissions in the Engineering Branch of the Royal Navy will shortly be granted. Applicants must be British subjects, under the age of 26 on December 31, 1946, and possess one of the following: University degree in Engineering, a Higher National Certificate in Engineering, or the Ministry of Education Diploma in Engineering granted to Engineering Cadets. Full particulars may be obtained on application to The Secretary of the Admiralty, (C.W. Branch II), Admiralty, London, S.W.1.

The United States and Great Britain, according to a *Journal of Commerce* despatch from Washington, are planning to hold talks this autumn with a view to setting up a world oil agreement and an international oil organisation under the United Nations.

A factory, providing employment for 500 people, is to be established at Ulverston-in-Furness by Glaxo Laboratories Ltd., on a site used for many years as an ironworks. The firm have arranged to purchase the site from the North Lonsdale Iron and Steel Company, Ltd.

I.C.I. stock and share department returned to London on August 21, from its war-time evacuation at Kendal, and is now at 34 Portland Place (LANgham 3454). Practically all the administrative departments of the company are now distributed in various offices in London.

The first of the British Celanese developments at Marchwiel, Wrexham, will be the establishment, probably next month, of a plastic department providing immediate employment for 200 people. Eventually, employment will be provided for about 3000 women and 2000 men.

A new laboratory for atomic research will be ready in October at Durham University. Professor F. A. Paneth, Professor of Chemistry at the University, who, during the war worked on atomic research in Canada on behalf of the Government, will be in charge, and will be assisted by three other scientists.

Fertiliser and chemical manufacturers in Leith are being severely hampered by the shortage of female workers which is now generally felt in the area. In many instances plants are working to only a fraction of total capacity, and have been forced to lay off certain departments and concentrate available labour in others. In Leith some 290 women are wanted, according to M.O.L. statistics, almost all for fertiliser manufacturing.

The Toilet Preparations (Consolidation) Order, 1946, (S.R. & O. 1946, No. 1372) revokes and re-enacts in consolidated form Nos. 3, 4, 5 and 6 Orders. Registered manufacturers of toilet preparations will now be permitted to mark their goods with brand names or trade marks; provision is made for the distribution of imported goods on the home market; and a new form of return, T.P./6, for goods manufactured and supplied by registered manufacturers, replaces form T.P./5.

In addition to the figures quoted on p. 242, the following changes have been made in the prices of refined oils and fats allocated to primary wholesalers and large trade users for the eight-week period ending October 12: Empire stearine, per ton c.i.f. £62 (in hardwood barrels 25s. per ton extra); premier jus (S. American), £73 15s., oleo oil, £90 (in softwood barrels or tierces, 25s. per ton less).

Three new "Trading with the Enemy" Orders (S.R. & O. 1946, Nos. 1373-5) signed on August 13 have the general effect of permitting trade with Austria and removing Board of Trade and Custodian control over money and property accruing in consequence of this authorisation. Austrian property, etc., in the U.K. continues under such control. Import and export licences can be obtained in the usual way, and traders are reminded that exchange control requirements must be complied with.

Government purchase of tungsten and molybdenum ores and concentrates has now practically ceased, and it has been decided to return to private trading in these materials. Purchase and import on private account may now be resumed, subject to import licence, applications for which should be made on the usual form, which should be forwarded to the Iron & Steel Control, Ministry of Supply, Artillery Mansions, 75, Victoria Street, London, S.W.1, for transmission to the Import Licensing Department.

Foreign News

A State monopoly has been established in Hungary for the purchase and sale of saccharin.

This year's American National Chemical Show will be held in Chicago concurrently with the meeting of the American Chemical Society, from September 9 to 13.

It is reported from Rhodesia that between 18,000 and 20,000 long tons of copper have been lost as a result of the strike in the mines there, which has lasted since July 15.

The Italian Government has granted a sum of 300 million lire to be used in the restoration of the Sardinian coalmines worked by the Società Carbonifera Sarda.

Bolivian output of antimony for 1945 was 5535 metric tons, all of which was exported: to the U.S., 5192 tons; to the Argentine Republic, 319 tons; to the U.K. 24 tons.

The editorial offices of the *Journal of Chemical Education* are moving, about September 1, from Brown University, Providence, R.I., to Scripps Institution, La Jolla, California, U.S.A.

The antimony mines at Cucma in eastern Czechoslovakia are again in working condition after damage caused by the Germans has been made good. Output amounts to 6 tons of amorphous antimony daily.

The nomination of works councils, composed of representatives of the workers and clerical staff of the Montecatini group, was agreed to at a meeting held on August 7 in Milan.

In French Morocco, the Bou Azzer cobalt mine produced about 70 tons (metric) a month during 1945. Demand from France for the mineral improved latterly, though it is reported that a stock of 3000 tons was in hand at the mine at the beginning of 1946.

A Federal Grand Jury at Denver, Colorado, has charged six corporations and five individuals with conspiring to fix prices and monopolise the U.S. vanadium industry in violation of the Sherman Anti-trust Act. The corporations concerned are the Union Carbide and Carbon Corporation, with four wholly-owned subsidiaries, and the Vanadium Corporation of America.

The chemical products department of the Standard Oil Company (Indiana) announces that it has now produced, in small quantities for research work, the sulphonic acids of methane and ethane, as well as mixed paraffin sulphonic acids. It is claimed that metal plating can be considerably speeded up by using these acids, which are said also to give brighter finishes.

A simple method for reclaiming contaminated rhodium plating baths is reported to have been developed by Abner Brenner and W. A. Olson at the Electrochemistry Section of the U.S. National Bureau of Standards. The undesirable metallic impurities are precipitated with potassium ferrocyanide and removed by filtration. The rhodium in the complex phosphate in the bath is not precipitated under the conditions of purification.

According to the Hungarian journal, *Villag*, a penicillin plant is to be erected at Budapest by United States interests, which will provide not only the necessary capital, but also all special machinery and equipment. Production will be based on U.S. patents, and it is reported that Professor Szent-Györgyi will occupy a leading position in the new plant's scientific work. It is hoped that the plant will be working within about 18 months.

Forthcoming Events

September 10-11. Institute of Metals (Autumn Meeting). Institution of Civil Engineers, Great George Street, London, S.W.1. September 10, 2.30 p.m.: Official business, followed by three papers. September 11, 10 a.m.: Simultaneous groups of papers (in Lecture Hall and South Reading Room); 1.15 p.m., Annual luncheon at Connaught Rooms, Great Queen Street, W.C.2. Applications to the Secretary not later than September 1.

Company News

The London Aluminium Co., Ltd., which became a public company last June, is paying an interim ordinary dividend of 10 per cent.

The United Glass Bottle Manufacturing Co., Ltd., has increased its interim dividend from 3½ per cent. to 5 per cent.

Cellactite & British Uralite, Ltd., report a net profit, for the year ended March 31, of £27,619 (£6057). Ordinary dividend is 20 per cent. (7½ per cent.).

Boots Pure Drug Co., Ltd., is paying an interim dividend of 10 per cent. (same) on the ordinary capital in respect of the year ending March 31 next.

Metal Industries, Ltd., are paying a final ordinary dividend of 7 per cent., making 10 per cent. (9 per cent.) for the year ended March 31. Profit after depreciation is £294,897 (£266,548).

The International Nickel Co. of Canada reports a net profit, for the first half of 1946, amounting to $12,211,663 ($13,527,594), and is paying a dividend of 42c. per share on common stock for the second quarter (39c.), making 77c. (86c.) for the half year.

Timothy Whites & Taylors, Ltd., announce the proposed issue in the near future of 323,862 ordinary shares of 5s. each for expansion and development purposes. The necessary capital increase is to be effected, it is suggested, by the conversion of 100,000 of the unissued cumulative preference £1 shares into 400,000 5s. ordinary shares. Net profit for the year to December 29 last was £155,758 (£140,009). Total ordinary dividend for the year was 30 per cent. (same). Forward, £99,143 (£84,569).

New Companies Registered

Warner Chemical Co., Ltd. (417,084).—Private company. Capital £15,000 in £1 shares. To carry on business as indicated by the title. Subscribers: E. W. Geere (permanent governing director); S. L. A. Mastin. Registered office: 92 Victoria Street, London, S.W.1.

Richard Parry & Co., Ltd. (417,057).—Private company. Capital £2500 in £1 shares. Industrial painters, factory cleaners and degreasing, chemical and fuel engineers, etc. Directors: R. M. Parry; W. G. Parker. Registered office: 36 Cannon Street, Birmingham.

Haines Development Co., Ltd. (417,026).—Private company. Capital £3000 in £1 shares. Manufacturers of and dealers in wood-wool slabs, chemical and general engineers, etc. Directors: W. H. Haines; F. M. Waid Smith; V. R. Watling; and M. T. Amos. Registered office: 7/8 Norfolk Street, London, W.C.2.

Cogas Chemicals, Ltd. (417,010).—Private company. Capital £25,000 in £1 shares. Manufacturers of and dealers in coke-oven gas, and producers therefrom of chemicals of all kinds, plastic substances, etc. Directors: W. G. Bailey; Dr. G. Frenkel; Norman Sadler. Registered office: 329 High Holborn, London, W.C.1.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BRITISH COAL DISTILLATION, LTD., London, S.W. (M. 24/8/46.) July 29, £3400 debentures, part of a series already registered. *£33,400. January 11, 1946.

CONSOLIDATED CHEMICALS, LTD., Bury St. Edmunds. (M. 24/8/46.) July 22, series of £8000 (not ex.) debentures, present issue £4600; general charge. *£2000. May 11, 1945.

Chemical and Allied Stocks and Shares

BRITISH Funds have continued firm, but chief attention in stock markets again centred on industrial shares, although profit-taking reduced some of the substantial gains recorded last week. There was widely-spread demand for iron, coal, and steel shares in view of the good yields ruling and hopes that dividends may be on a somewhat less conservative basis than during the war period. The prevailing assumption is that the Government's nationalisation plans may not be effected for two years or more.

Imperial Chemical at 45s. 6d. lost part of their recent advance, but attracted renewed attention at the lower level, as the yield offered compares favourably with the average return on other leading industrial shares. Moreover, the general belief is that there seem good prospects of the 8 per cent. dividend, which has ruled for some years, being maintained in future. The group has big

expansion schemes in hand from which earnings should benefit as time proceeds. Dunlop Rubber at 75s. 3d. also lost part of the good rise shown in recent weeks, and Turner & Newall eased to 89s. 3d., but United Molasses were favoured up to 55s. 9d. on the possibility of an increase in the interim dividend. The units of the Distillers Co. held firm at 139s., but elsewhere, British Plaster Board eased to 34s. 3d., and Associated Cement to 70s. 3d. A moderate decline to 40s. 9d. in Triplex Glass was attributed to market doubts whether there will be an increased dividend for the financial year ended June 30. On the other hand, United Glass Bottle ordinary were good at 93s. 9d., following the higher interim dividend; recently the company redeemed the whole of its debentures; but for many years earnings on the ordinary shares have been substantially in excess of dividend payments.

Weardale Steel deferred advanced to 44s., and Hilton Main shares rose to 41s., the latter on expectations that the final dividend will be at the same rate as the interim. United Steel were good at 26s. 3d., Dorman Long rallied to 27s. 6d., Staveley were 49s. 9d., and Shipley 36s. 6d. T. W. Ward also strengthened to 43s. 9d. Ruston & Hornsby were 64s. 3d., while Stewarts & Lloyds rose further to 52s. 6d., and Tube Investments were £6 3/16. Metal Box shares at £6 3/32 were higher again. B. Laporte remained firm at 100s., with W. J. Bush 87s. 6d., Burt Boulton 26s. 3d., Cellon 30s., and British Drug Houses 58s. Monsanto Chemicals 5½ per cent. preference were 25s., and Greeff Chemicals Holdings 5s. ordinary 12s. 6d. Fisons showed firmness at 60s. 6d. on the results and latest developments; while Genatosan 1s. ordinary were marked up to 12s. 6d. following the offer for the shares. Cooper McDougall were 42s. 6d. In other directions, introduction to the Stock Exchange of the 5s. ordinary units of the old-established manufacturing chemists' business of Stevenson & Howell attracted a good deal of attention, the quotation rising to 29s., compared with a placing price of 26s. 9d.

Boots Drug have been firm at 63s. 9d., while Sangers moved up further to 34s. 6d., and Timothy Whites were steady at 48s. 6d. on the full results. Lever & Unilever at 45s. 6d. failed to hold all an earlier improvement. Aspro shares continued active with dealings up to 38s. 9d., and Griffiths Hughes were 62s. 6d. Among plastics, De La Rue at £11⅞ lost part of their recent rise, British Industrial Plastics 2s. ordinary were 7s. 9d., British Xylonite were £7½, and Erinoid were active around 16s. 6d. British Glues showed firmness at 15s. 7½d., and British Tar Products 2s. 6d. units were 11s. 10½d. Among Oils, Anglo-Iranian receded to 97s. 6d., and Burmah Oil at 70s. 7½d. eased earlier in the week on the news from India. British Borneo Petroleum showed a renewed rise to 30s. 6d., and elsewhere Mexican Eagle Oil became active on rumours of re-opening of compensation negotiations, which, however, lacked confirmation.

British Chemical Prices

Market Reports

A FAIR volume of inquiries has been circulating in the London general chemical market during the past week and the movement into consumption so far as the principal outlets are concerned has been on steady lines. The price position is unaltered and in most instances the undertone is very firm. Among the soda products there have been steady deliveries of refined nitrate of soda and hyposulphite of soda and available supplies of bichromate and yellow prussiate of soda are readily taken up. A rather tight position continues in the potash section where, with the possible exception of permanganate of potash, the volume of inquiries exceeds available supplies. In other directions a steady demand is reported for white powdered arsenic, formaldehyde, and peroxide of hydrogen. The coal-tar products market is without notable feature, quotations throughout continuing very firm with little on offer for spot or near delivery.

Manchester.—Sellers on the Manchester chemical market have handled a fairly large number of fresh inquiries for both light and heavy products during the past week and these have resulted in useful additions to order-books. It is still the case that actual deliveries of textile and other chemicals against contracts are affected to some extent by holiday conditions in Lancashire towns, but the influence of these is gradually becoming less pronounced and will cease altogether within the next few weeks. Strong price conditions are reported in almost all sections of the market. There is a steady offtake of the principal tar products and a fair amount of new business has been reported.

Glasgow.—The Scottish heavy chemical market showed considerable activity during the past week. All classes of light and heavy chemicals were in demand in the home market, with prices everywhere on the upgrade. Supplies, of course, are still difficult and in no commodity appear to meet the demand. Inquiries from overseas markets were normally busy and reflected the world need for raw materials of all kinds. Prices in this case also were very firm with, in many cases, a tendency to increase.

Price Changes

Whale Oil: Refined hardened deodorised, per ton naked ex works, 42°, £89; 46/48°, £90.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Pteridines.—American Cyanamid Co. 22289-92.

Hydrocarbons.—C. Arnold (Standard Oil Development Co.). 22564.

Organic nitriles.—C. Arnold (Standard Oil Development Co.). 22565.

Volatile fuels.—C. Arnold (Standard Oil Development Co.). 22566.

Benzoate.—R. G. Blumenthal. 22376.

Dyes.—British Celanese, Ltd. 22078.

Ethers.—British Drug Houses, Ltd., F. M. Berger, W. Bradley, and A. C. R. Dean. 22025-6.

Ethers.—British Drug Houses, Ltd., W. Bradley, J. Forrest, and O. Stephenson. 22085.

Ascorbic acid stabilisation.—Abbott Laboratories. 22876.

Ethyl alcohol.—C. Arnold. (Standard Oil Development Co.) 22725.

Treatment of oils.—D. Balachowsky. 22796.

Glyceride oil compositions.—Best Foods, Inc. 22839-41.

Powdered metals.—Birmingham Small Arms, Co., Ltd., S. C. Wilsdon, and P. J. Ridout. 22775.

Nitrogen compounds.—G. D. Buckley, N. H. Ray, and I.C.I., Ltd. 22790.

Lubrication.—Carbide & Carbon Chemicals, Inc. 23095.

Electroplating.—Carnegie-Illinois Steel Corporation. 22987.

Sodium chromate.—Chrome Metals (Aust.) Pty., Ltd. 22723.

Polymeric materials.—J. G. Cook, D. A. Harper, and I.C.I., Ltd. 23071.

Biguanidine derivatives.—A. F. Crowther, F. H. Curd, F. L. Rose, and I.C.I., Ltd. 23076.

Polishing compositions.—A. Fenby. 22811.

Coating of metal articles.—H. M. Freud. 22986.

Carbonisation of coal, etc.—Gas Chambers & Coke Ovens, Ltd., and F. Ritson. 23160.

Complete Specifications Open to Public Inspection

Synthetic resins.—Soc. L'Impregnation. January 24, 1940. 18387/46.

Dry-spinning of solutions of polymerised vinyl compounds.—Soc. Rhodiaceta. August 24, 1942. 25834/45.

Extruded products having a basis of cellulose derivatives and process of their manufacture.—Soc. Rhodiaceta. August 11, 1943. 25835/45.

Method of compounding rubber and product.—Wilmington Chemical Corporation. January 26, 1945. 2551/46.

Plasticised resins.—Bakelite, Ltd. January 30, 1945. 2708/46.

Laminated articles having craze-resistant coatings, compositions for producing such coatings.—British Industrial Plastics, Ltd. January 31, 1945. 957/46.

Preparing crystalline penicillin in the form of its ammonium salt.—Commercial Solvents Corporation. January 31, 1945. 651/46.

Soluble polyvinyl chlorides.—Cie. de Produits Chimiques et Electrometallurgiques Alais, Froges & Camargue. January 31, 1945. 1792/46.

Manufacture of saturated products from natural or treated oils.—Cie. Française de Raffinage. July 4, 1941. 20039-40/46.

Distillation of bituminous limestones.—Cie. Française de Raffinage. September 16, 1942. 20041/46.

Synthetic process for the manufacture of oleaginous products.—Cie. Française de Raffinage. December 19, 1942. 20186-7/46.

Treatment of shale oil.—Cie. Française de Raffinage. April 9, 1943. 20376/46.

Alcoholysis of oils having a high acid content.—Cie. Française de Raffinage. May 21, 1943. 20377/46.

Complete Specifications Accepted

Synthetic resin compositions.—Distillers Co., Ltd., and J. J. P. Staudinger. July 21, 1943. 579,248.

Prevention of corrosion of magnesium and magnesium base alloys.—Essex Aero, Ltd., R. J. Cross, and E. F. Maillard. November 14, 1942. 579,163-4.

Protection of magnesium and magnesium-rich alloys against corrosion.—Essex Aero, Ltd., R. J. Cross, and E. F. Maillard. November 14, 1942. 579,165.

Thermoplastic moulding compositions containing ethyl cellulose.—Hercules Powder Co. June 19, 1943. 579,184.

Catalytic dehydrogenation of hydrocarbons.—Houdry Process Corporation. July 27, 1943. 579,102.

Interpolymerisation of 1, 3-butadienes and methyl methacrylate.—Imperial Chemical Industries, Ltd. September 18, 1941. 579,235.

Method for saccharifying cellulose materials by means of diluted mineral acids. —Les Usines de Mello. March 27, 1941. 579,116.

Volatile deodorising or disinfecting blocks. —B. Lipton. December 15, 1943. 579,199.

Dyeing of textile materials.—Mathieson Alkali Works. December 30, 1942. 579,134.

Rotary fluid pumps, compressors or the like.—A. A. Mercer. September 4, 1944. 579,264.

Ethyl cellulose moulding compositions.—W. H. Moss, and W. E. Cowley. July 23, 1943. 579,250.

Apparatus for cleaning heat exchangers.—C. W. Parris and J. R. Jenkinson. July 17, 1944. 579,141.

Refractories.—Permanente Cement Co. June 14, 1943. 579,098.

Manufacture of lactones.—Soc .of Chemical Industry in Basle. Cognate applications 4274/43 and 4275/43. March 16, 1942. 579,169.

Method for ageing solutions of colloidal material from which artificial filaments and like materials may be spun and apparatus therefor.—R. H. K. Thomson, W. Sever, and I.C.I., Ltd. April 28, 1944. 579,089.

Ceramic pigments.—W. W. Triggs (Harshaw Chemical Co.). April 24, 1944. 579,139.

Manufacture of xanthopterin and related compounds.—Wellcome Foundation, Ltd. April 6, 1944. 579,138.

Treatment of vinyl chloride-vinylidene chloride co-polymers.—Wingfoot Corporation. June 11, 1943. 579,181.

Non-corrosive hydrocarbon fuels and solvents.—C. Arnold (Standard Oil Development Co.). February 9, 1943. (Convention date not granted). 579,369.

Manufacture of barium carbide.—J. G. Bennet, and M. Pirani. (Cognate applications 10547/42, 15715/42 and 10014/43.) July 28, 1942. 579,321.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1418. August 31, 1946 Annual Subscription 21s. Overseas 26s.

Students and Employment

THERE was never so great a demand for trained men and women as there is to-day. There was never so little demand for the unskilled. Everyone knows that the increasingly scientific and technical development of industry is rendering the unskilled worker less needed, and that in the foreseeable future the labourer as we have known him in the past will disappear, and his place will be taken by the "tradesman." The obvious deduction is that the engineer or senior (whatever he may be called) must be still more highly trained if he is to maintain his position as the man who knows what should be done. Mechanisation is largely responsible for this change. We visited a chemical works lately and were told that the works to-day is making nearly three times as much product as in 1930 with 50 fewer men; the reason is mechanisation, and the change in processing has been accompanied by a parallel change in the type of men employed. They are now, we are told, mechanically minded, able to look after machinery. This change has been accompanied in the chemical industry by an increasing complexity in the chemistry and physics of the processes in use, and this again reacts upon the character of those employed in it.

The answer to these problems must lie in the training and higher education of those who are to work in industry. There is, of course, first the training of the rank and file. No longer can we expect to take boys from schools, put them into the works and let them learn whatever they may pick up. That method was fatally easy for employers to follow 20 or 30 years ago, but it resulted in a great deal of ignorance, for the blind led the blind and few received the right kind of training. We are now beginning to understand that firms must train their own men. Few of those who enter industry by the lower rungs of the ladder that may lead to the heights in due course can hope to attend day classes at technical colleges after leaving school. It is, therefore, necessary for employers to arrange regular training for new entrants, and for such of the older men as are willing to be trained; and this training, if at all possible, should be done in the daytime, as a part of the normal employment. If this is not possible, evening classes should be arranged, paid for wholly or in part by the firm, and the employees encouraged to attend. If wage increases and promotion are made to depend at least partly on the results obtained at these classes, encouragement to do well is provided.

On Other Pages

How far is this true education? The answer, of course, is that it is not education in the real sense at all. It is vocational training. It is doubtful whether most people are fitted to aspire to true education. There is nothing to prevent a man from educating himself; the facilities exist and are open to those who can show that they have a mind to take advantage of them. There are few people to-day, however, among the rank and file who are prepared "to scorn delights and live laborious days." Those who do so have their reward. All that can be done for most people is to take care that all are given sufficient vocational training to enable them to do the skilled or semi-skilled work needed in industry to-day. By ancient tradition we are a nation of craftsmen, and it was only the industrial revolution that converted so many into beasts of burden. That phase is passing rapidly. We must again become a nation of craftsmen, but craftsmen of a different kind.

That, then, is one problem. There are others connected with the training of the staff that is to control processes, works, and businesses. The outstanding problem at the moment is that of numbers. Chemical engineering is a case in point. We are told that only about 40 students are being trained in chemical engineering to-day in this country. In the U.S.A., with a population about 2½ times ours, there are 3000. But training in chemical engineering is not true education. It is vocational training on a high plane—and little more. Sir D'Arcy Thompson has lately written: "There is another matter which is more serious still and makes, to my mind, a greater change since I was young, and that is the way men come to the university, not for the love and joy of learning, but for the business of passing an exam. They do not hitch their wagon to a star as so many of my old companions did; they only want a degree, and a job. In short, we have plenty of undergraduates, but a sad lack of students."

There is our most fundamental problem. We have little doubt that if we set about teaching as we set about agriculture or any other form of "culture" we could turn out all the technologists we need. But they would be nothing more than skilled technicians, having more knowledge of science and engineering than the workmen who do their bidding. Is industry satisfied with men of this type? We believe that in general, a very large number of such men would be completely successful in filling the posts that industry has to offer. There are the "general practitioners" of chemical engineering, chemistry, mechanical engineering, electrical engineering, civil engineering, and so forth. Industry says to those men: "Go to a university; get the label which shows a certain proficiency; then, but not till then, we will employ you." So it comes about that the majority "only want a degree, and a job."

True education should be broad-based. But what has industry to offer such a one? The answer, we fear, is: very little. So far as our experience goes, industry rarely welcomes the classical scholar, the historian, the man with a wide and fertile mind. To him it says: "You may turn out good, you may become a captain of industry. Keep on trying. But what a pity you did not take up some really useful subject. We would have given you at least £5 or £6 a week then. No doubt someone will employ you and when you have shown that you can really do something, we will think about you again."

Thus it is that the man of education and learning, as distinct from the plain technologist, gets little encouragement from industry. That is a pity because, although men with a liberal education may find it difficult to design even a tank to hold a liquid, they often make the finest managers, and when they apply their minds to trade and commerce their worth becomes above rubies. We can call to mind many who went through university in the classics, in history, in law, and in similar subjects who subsequently became involved in industry with great advantage to industry. We shall not speak of the living, though there are many examples. We shall instance only Sir David Milne Watson, while he lived, the leader of the gas industry; Lord Moulton, mathematician and lawyer; Lord Melchett, scholar as well as scientist; and there is many another such. Among the scientists whose names live for evermore, can it be doubted that those who studied at universities "for the joy and love of learning," who "hitched their waggon to a star," figure preponderatingly? It is a sobering thought that though our demand for numbers may well be filled by mass production of students, if we are not very careful we may fail to produce the great leaders in science, in trade, in business, for which this country has ever been renowned.

NOTES AND COMMENTS

Some Historical Exhibits

IN the gradual revival, after their war-time closure, of our national museums, chemistry, up to the present, has had singularly little share. The eager chemical recruit, whether to the professional or the industrial side, has had to take the word of his elders and (presumably) betters concerning the achievements of the great chemists of the past. The engineers have fared better; but then their exhibits have always been more spectacular—have had a greater box-office pull, if we may be permitted the expression—and many of them can stand roughish handling by the very young enthusiasts for the engineering profession. Historical chemical exhibits are relatively unspectacular and demand careful handling and storing. Nevertheless, a selection of the most interesting exhibits from the chemical department has just been put on view again at the Science Museum, South Kensington, none of them looking any the worse for their storage during the war—this in itself being a triumph of organisation. This is not the place to print a catalogue of them; readers should go and see for themselves; but we cannot refrain from recording the reappearance of the chemical specimens prepared by Faraday and Liebig, the chemicals used for Louis Daguerre's photographic process, some dyes prepared by Hofmann, and the first specimens of thallium and its compounds. Faraday's own chemical cabinet is again on view, and, among historic apparatus, the Kelvin rheostat, the Nicol prism analyser and polariser and apparatus used in electrodeposition and in chemical crystallography. So far only a fraction of the Museum's chemical treasure is on view, but it is a start, and an earnest of what is to come when reconstruction is complete.

The Steel Board

LAST week we were kept breathlessly awaiting the Minister of Supply's statement about the Steel Board. From day to day the news was postponed, and we reserved space in our columns in order to have plenty of room for the epoch-making pronouncement which was to have so profound an effect on one of the basic industries of the nation. Wednesday came, and with it the announcement, which amounted to little more than that the Minister was prepared to use the Board for advice on how the steel industry ought to be run. It was not difficult to find some more cogent news with which to fill our columns; for if ever there was a damp squib, this was it. Because the Iron and Steel Federation has agreed to participate in the Board on these advisory terms, the outside-left Press accuses the Minister of surrendering to the "steel barons." What has, in fact, occurred, is that the Minister, coached, doubtless, by Dr. Van der Bijl, has seen that to nationalise steel is not as easy as all that, nor can it be brought about in a day. Dr. Van der Bijl has declined the honour of the first chairmanship of the Board, and we must now await further news of its constitution. Mr. Lincoln Evans, we know, is to be a member; we shall be interested to learn in due course the names of the other members, among whom, it is promised, will be included "men with direct managerial experience of the industry."

The Left-Wing View

FROM the standpoint of the industry, the undertaking given by the Iron and Steel Federation, that they "will press on with the modernisation programme with all possible speed," may mean quite a lot or it may mean nothing at all—it all depends on the significance of the operative word "possible." Unfortunately, non-committal vagueness has been characteristic of previous utterances from this source, and the record of the Federation's attitude towards modernising is not a specially handsome one. Whoever wishes to understand the outlook of the opponents of the Federation—and the partisans of nationalisation—should glance through a pamphlet, *Steel—the Facts*, by Henry Owen, just published by Lawrence and Wishart at 4s. This is a blunt but authoritative statement of the left-wing point of view, and Mr. Owen certainly has some hard things to say, notably in his Sections 5 and 6, "Monopoly and Prices," and "Production and Politics." He stigmatises the May Report for the sloppiness of its language, and some of his stories about cartel action against non-members make lurid reading. Confirmed opponents of nationalisation of this vital industry would do well to read it, and learn what evidence of past inefficiency the other side has put forward. The ordinary man-

in-the-street, whose well-being depends so largely on the good management of the iron and steel industry is sorely tempted to exclaim " A plague o' both your houses "!

Iron and Steel Research

SHORTLY before we went to press, the British Iron and Steel Research Association issued a booklet based on talks given by its Director, Sir Charles Goodeve. In this, it is pointed out that everyone agrees that research must play a key part in maintaining the place of the British iron and steel industry in the pre-eminent position necessary to the prosperity of the country, although people may differ as to the best method. Set up during the last part of the war, the basic funds being provided on behalf of the industry by the British Iron and Steel Federation, the Association is primarily concerned with background or objective research, and with new techniques, processes, etc., of common interest, its work lying between that of the university laboratores and industrial laboratories. It is rightly stressed in the booklet that the extension of co-operative research activity in the Association does not lessen the need for research laboratories in the industry itself, but, rather, increases it. In accordance with one of the great lessons of the war, it has been decided not to attempt to centralise the research work of the Association in any one laboratory, at least for the time being. Wisely, the Association will continue the policy of the parent bodies of using all the existing research facilities in the country, supplementing these where efficency demands by special groups or research stations dealing with certain fields.

Drop in Coal Production

JUNE was considered a bad month for coal production and now comes the announcement by the Ministry of Fuel and Power that during July production dropped yet again, this time by 121,800 tons to 3,272,500. These figures relate to mined coal only; there was an increase of 26,500 tons in the production of opencast coal. The reduced output of mined coal is largely, if not wholly, accounted for by the fact that July is the recognised holiday month in the Scottish coal districts, and, to a less extent, in some Midland and Northern areas. Compared with a year ago, there was a slight improvement in the over-all production of mined coal, despite the fact that there were fewer wage-earners on the colliery books. In this there is reason for a certain amount of satisfaction, but there can be no complacency about the statement that during July there was an appreciable increase in absenteeism, particularly in voluntary absenteeism. Another factor not without significance is that the number of workers on the colliery books, which, since last autumn, had been slowly increasing, showed no further increase from June to July. It may be argued that in the circumstances the figures given cannot lead to any definite conclusions, but it is patent that even with a reduction of absenteeism the future output of coal is still largely an unknown factor and that those industrialists who are considering the use of oil as an alternative source of energy are wise.

Welsh Industries Fair

DESPITE fuel problems and many other difficulties, British trade, on the whole, is making a good recovery from wartime restrictions. An indication of this—small, perhaps, but significant in its way—is that all available space has now been booked for the Welsh Industries Fair which is being held in Cardiff from September 23-28. This event is in the nature of a " repeat performance " of the fair held earlier in the year (see THE CHEMICAL AGE, June 1, p. 616), and has been arranged to accommodate firms who were unable to show on the previous occasion. Encouraged by the success which has attended their efforts this year, the organisers of the Fair have planned to hold it next year in London, from January 1-7. This will be the first national all-Welsh show to be held outside the Principality, and many firms are expected to take advantage of the opportunity of displaying their wares in the Metropolis. The chemical and metallurgical industries play no small part in the output of an amazing variety of products now being manufactured in Wales and Monmouthshire.

The Government of Saskatchewan is proposing to build and operate a sodium sulphate processing works at Lake Chaplin, West of Regina, according to a statement by the Premier of the province. A " saline deposit " method will be used; two private operators are already working at Lake Chaplin, using the mining method. Except for some deposits in Georgia, Saskatchewan has a monopoly in North America of natural sodium sulphate.

Chemical and Allied Industry in Sweden

The Importance of Wood and Water Power

AMONG the countries of the world, Sweden is one of those most richly endowed with forests, half its area being wooded. Though she lacks a domestic supply of such important industrial products as coal and mineral oils, a close connection exists between forestry and the chemical and mining industries. The reduction of iron ore by charcoal is still the most common method used; the wood-pulp industry is another branch of the forest industries that has grown up in the last two decades, and the rapid development in the chemical pulp industry has found good use for valuable chemical products from pulp-mill waste. Thus Sweden's industrial development is largely due to, and based upon, her abundant natural resources of timber, ore, and water power, coupled with technical enterprise in their exploitation.

Iron and Steel

For nearly 1000 years Sweden has supplied the world with iron, highly valued for its purity. Until quite recently, some 40 per cent. of all the iron manufactured in the world was produced in Sweden, and exported in considerable quantities, chiefly as unwrought iron and steel for certain specific purposes. As time went on, however, the Swedish iron and steel industry gradually became concentrated on the more highly processed types of steel manufactured by the Bessemer, open-hearth, and electro-steel processes. The first properly constructed furnace for the manufacture of such quality steel by the Bessemer process and the first Bessemer converter to yield such steel in continuous production were built by G. F. Göransson at an iron works in Central Sweden in 1858.

As to the raw material, it is to be noted that the Swedish ores now being mined possess an average iron content of 50-55 per cent., and are distinguished by a low sulphur content of less than 0.01 per cent. and a phosphorus content below 0.005 per cent. Though in North Sweden the ores, generally, have a higher phosphorus content, they are, on the other hand, the richest in iron. Whereas the European ores contain on an average 35-40 per cent. iron, over 1000 million tons of the estimated 2000 million tons of iron ore worth mining in Lapland have an iron content of 60-70 per cent.

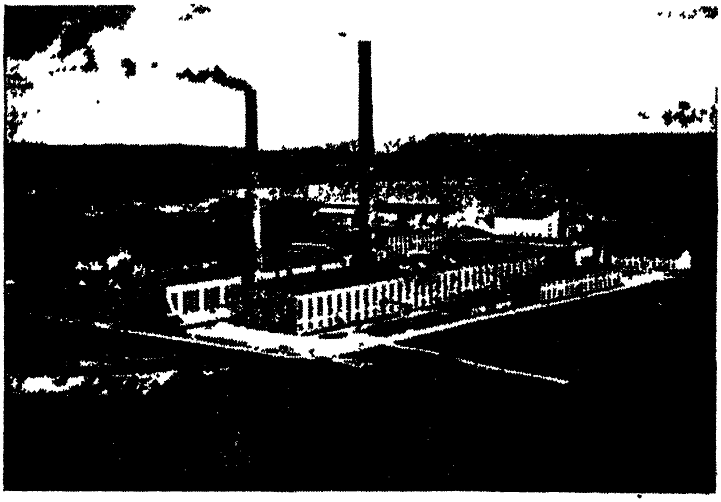
Another important factor in the production of pig iron as a basic material for the manufacture of special types of steel is the good quality of charcoal, free from sulphur and phosphorus, which Sweden obtains from her forests, where pine and spruce are practically the only trees that are industrially used. Sweden's output of charcoal pig iron, however, has considerably declined owing to an increased use of scrap iron in steelmaking and of Swedish sponge iron now produced in conjunction with the wider use of scrap iron in the manufacture of steel. Swedish sponge iron, with maximum 0.015 per cent. phosphorus and 0.10 per cent. sulphur, is an extremely pure material and consequently highly suitable for open-hearth, electric-arc and high-frequency furnaces, for the production of various kinds of quality steels.

These special steels require also, apart from pure basic materials, ferro alloys with a low carbon percentage and a high degree of purity. The production of these alloys in Sweden has become very important, and she has a large export of ferro-silicon, ferro-chromium and ferro-manganese. Sweden has been able to maintain a leading position in steel production, thanks largely to close co-operation within the industry. Research work is carried on continuously by the different works in collaboration with, and with the support of, the Government. The centre for iron and steel research is the institution known as the Swedish Iron-masters' Association, founded in 1747.

Pulp Industry

Of the main branches of the pulp industry, one produces mechanical, the other chemical pulp, either as sulphite or sulphate cellulose. These three are the common types of pulp not only in Sweden but also in other pulp-producing countries. A fourth type is obtained by means of the soda process, whereby aspen and certain other hardwoods are manufactured into paper pulp. This process is of considerable importance in the United States, but in Sweden good quality aspen wood is not sufficient even for the large match industry. Generally speaking, conifer wood makes better pulp than hardwood because of its longer fibre and consequently stronger paper. Chemical pulp in its turn makes stronger paper than mechanical pulp, for the latter contains not only the actual cellulose fibre, but also a large part of the original material found within the fibrous structure of the wood, such as lignin, carbohydrates and other material.

Sweden is the world's biggest exporter of pulp. During 1939 the export amounted to 2.3 million tons, with a combined value of nearly 350 million kronor, corresponding to close on 20 per cent. of Sweden's total exports. The pulp industry is favoured by some rather remarkable natural advantages.



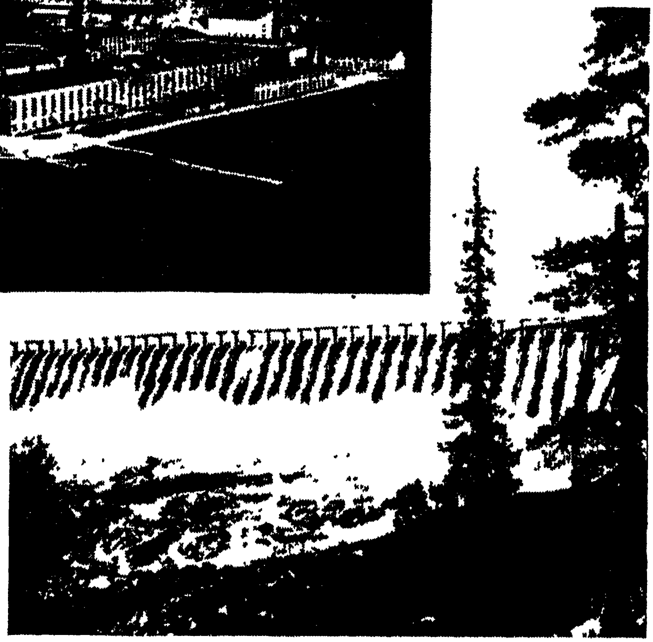


Fig. 1. (above). A Swedish pulp factory at Ostrand in the Sundsvall district.

Fig. 2. (right). Water-power in Sweden: a regulation dam at a power plant.

Swedish spruce and pine wood is an exceptionally good raw material for pulp making and, thanks to the Swedish timber-floating system, the pulp wood can be conveyed at a comparatively low cost from the depths of the forest to the pulp mills on the coast. About 500 million cu. ft. of wood are floated down to the mills each year. All the streams that could be utilised for floating have been developed and combined into a network for this purpose, and the floating costs have become so low that no other form of transportation can compete with this system.

The particularly suitable quality of the raw material is attributable to the northerly situation of the Swedish forests, where the growth of the timber is so slow that a tree requires twice as long to reach a certain size in Sweden as in more southerly countries, a state of affairs which leads to the development of a particularly strong and flexible fibre.

The first pulp mill was established in Sweden as early as 1857, only a few years after the invention of the method of making paper pulp out of wood. Since then Sweden's output of mechanical pulp has shown a steady increase, reaching, in 1939, about 700,000 tons, of which more than half was consumed in the country for the production of newsprint. The remainder, well over 300,000 tons, was exported in the form of either wet or dry mechanical pulp. At quite an early stage, however, it was found that mechanical pulp did not possess the durability and strength requisite for the manufacture of finer grades of paper, and efforts were therefore directed to devising a process for releasing the wood fibres by chemical action. The type of wood pulp that was gradually obtained by this means, and which is generally called chemical pulp, wood cellulose, or merely cellulose, has by degrees acquired such importance that during the years immediately before the war world production was quantitatively about double that of mechanical pulp, while the value of the output of chemical pulp in pre-war days was four times as high as that of mechanical pulp.

Distinction must be made between sulphite and sulphate cellulose, though Sweden played a leading part in the technical development of the methods for producing

both these types of chemical pulp. C. T. Ekman was the first to solve the practical problem of the production of sulphite pulp, and in 1874 he built in Sweden the world's first sulphite mill. The product known as strong, unbleached sulphite cellulose is now the most important article in Sweden's pulp trade. It is used in the manufacture of finer grades of paper, and in recent years has increased rapidly in importance as a raw material for the manufacture of artificial silk (rayon) and cell-wool (staple fibre). The type of pulp which is used as raw material for these products—known as viscose pulp—is now produced by many Swedish sulphite mills and has become a leading export item.

Other highly processed types of bleached sulphite cellulose have lately been developed, including super-purified dissolving cullulose, which is characterised by the high chemical stability. These types, which fetch high prices and so far are produced on only a small scale, are used in the manufacture of synthetic textile fibres and cellulose lacquers, in nitrating processes, etc.

Whereas sulphite pulp is made almost exclusively of spruce wood, pine wood is the raw material for sulphate cellulose. Methods of producing this kind of pulp were invented at an early date. During the 1880's the Swedish engineer, A. Müntzing, made a substantial contribution in this field by his method of producing " kraft " pulp, which is characterised by a very strong fibre of comparatively dark colour. The well-known Swedish kraft paper is made of such pulp and it, too, has become an important export product. About 1930 Swedish sulphate mills developed new methods of bleaching sulphate pulp. Bleached sulphate pulp possesses not only great strength and durability, but also a high degree of whiteness, and a considerable demand has arisen for this type of pulp for certain purposes.

Another sphere of utility for cellulose is in the manufacture of synthetic textile fibres. In 1939, world production of rayon and cell-wool amounted to one million tons, which meant that 10 per cent. of all textile goods were produced with artificial fibres. Since then, considerable progress has been made in the production of synthetic textile raw materials based upon cellulose, and new types and qualities have been tried. Wood cellulose is also used as an animal feeding-stuff, and Sweden produced during the war about one million tons of fodder cellulose. During the same period synthetic albumen, the so-called fodder yeast, was used, like fodder cellulose, primarily as cattle feed, and, after undergoing certain processes, also for human consumption.

Since wood cellulose became of cardinal importance in the sphere of plastics, the demand for the Swedish product has increased considerably. As early as 1860 scientists had evolved the art of making plastic substances from cellulose, the first being celluloid, a mixture of cellulose nitrate and camphor. In many fields celluloid has soon been ousted by other synthetic products, but it is still the only material that meets the requirements of cinematographic films. An explosive form of this nitrate is a component of smokeless gunpowder and of certain high explosives; and it is the chief component in the hard glossy lacquer used, *e.g.*, for the

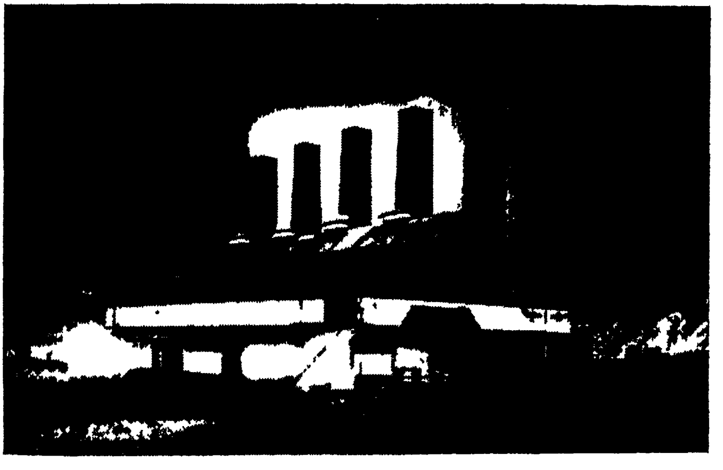


Fig. 3. A smelting house for ferro-alloys at the works of the Uddeholm Co., one of Sweden's oldest and largest industrial foundations. Its activities cover metallurgical and chemical works, pulp mills and hydro-electric plants.

Fig. 4. An annealing plant for cold rolled band and strip steel at the Sandvik works, one of the largest iron and steel works in Sweden.

painting of motor cars. It is also the basis of the wrapping material known as viscose foil (Cellophane).

Many by-products from the manufacture of cellulose have acquired increasing importance, *e.g.*, the production of sulphite spirit. In the production of viscose pulp no less than 125 litres of 95 per cent. spirit are obtained per ton of pulp and the capacity of the Swedish sulphite spirit distilleries now amounts to nearly 100 million litres of 95 per cent. spirit per annum. Most of it is used as motor fuel, while a considerable quantity, in a more rectified form, is employed for human consumption and in various synthetic preparations. Another important by-product is liquid resin, the tall-oil of commerce. Before the war this product was largely exported, but during the war it became an important raw material for the domestic manufacture of soaps. Modern chemistry also uses derivatives of liquid resin not only for detergents, but also as a raw material in the manufacture of printers' ink. A by-product in the manufacture of sulphate cellulose is turpentine oil, and many others now obtained are semi-finished products for the manufacture of medical preparations and for the organic chemical industry, as well as for synthetic rubber production.

Besides the chemical products already mentioned, which originated and derived in connection with Sweden's main industries, many more have given rise to Sweden's organic chemical industries. Sulphite spirit is used as a raw material for glycoles, solvents, acetic acid, ether, etc., and cellulose itself has become a raw material for derivatives such as methyl and ethyl cellulose. By-products from the manufacture of charcoal are formalin and methanol, and raw materials for tanning extracts are likewise derived from forestry.

Sweden is a pioneer country in the explosive industry since the revolutionary inventions of the brothers Alfred and Imanuel Nobel. The former invented dynamite and smokeless powder and a large-scale explosives industry has since grown up in Sweden, originally based on the Nobel inventions, extending in recent years to the manufacture of nitrocellulose for laquers and a number of articles in the sphere of aromatic chemistry, among other things, of saccharine, acetyl-salicylic acid, etc.

The manufacture of medical preparations in Sweden is of comparatively recent date; simultaneously with inventions in other countries, and independently of them, the Swedish medico-chemists manufactured the various sulphonamid preparations, hormone substances and vitamin products.

If the forest has largely dictated the trend of Sweden's organic chemical industry, the electric energy generated from the waterfalls

has served as the main foundation of the inorganic chemical industry, for this involves a great number of electrochemical and electrometallurgical processes which require a large supply of cheap electrical power.

An important section is the production of inorganic chemicals based principally on iron pyrites or pure sulphur. These were formerly imported on a considerable scale, but since the discovery of the rich ore fields at Boliden, so large an output of iron pyrites has been obtained that Sweden has not only become self-sufficient, but has actually been able to enter the world market as an exporter. The company working these ore fields is also the world's largest producer of arsenic. Certain quantities of this last are exported in the form of wood-impregnating preparations and plant-protecting insecticides, but the output of arsenic is so enormous that only a minor quantity can at present find a market.

The Swedish electrochemical companies produce, *inter alia*, chemically pure alkalis, which have for many years enjoyed a world-wide reputation. Their electrometallurgical production is responsible for a number of export articles such as ferro-alloys and metal compounds, as well as synthetic abrasives such as electrocorundum and siliceous carbide. Sweden was the first country in the world to adopt the electrochemical manufacture of perchlorates, and when the first Swedish electrolytic chlorate works was built in the 1890's it had only one predecessor.

The products just mentioned are very largely manufactured for export, though a considerable portion of the chlorates is used in the manufacture of matches. Swedish safety matches have occupied a unique position in the world for nearly 100 years, their reputation being largely due to Swedish mechanical inventions for their manufacture. Not only are safety matches a Swedish invention, but so are the ingenious machines that impregnate the matches with paraffin, provide them with their ignition heads, and pack them in the boxes.

Another leading product of the electrothermal industry is calcium carbide, large quantities of carbide being utilised in the Swedish artificial fertiliser industry for the production of calcium cyanamide. Other artificial fertilisers manufactured in Sweden are nitrolime and superphosphates. The production of superphosphates is closely allied to that of sulphuric acid, and the capacity of the Swedish factories has in recent years been considerably enlarged, and much mechanical ingenuity applied to the processes of manufacture (see THE CHEMICAL AGE, 1945, *54*, 691). The same applies to the works which manufacture—on the basis of rock salt and sulphuric acid—hydrochloric acid and sodium sulphate, aluminium sulphate, and kindred materials.

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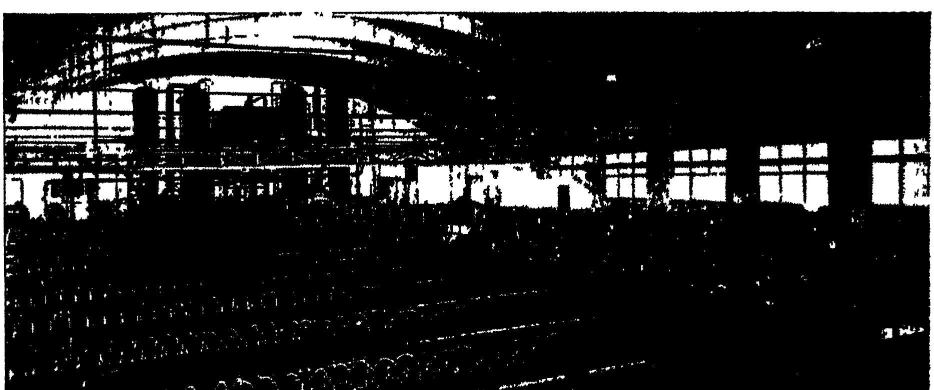

Fig. 5. The electrolytic alkali plant of the Elektrokemiska Co., Bohus, Sweden.

LETTERS TO THE EDITOR

B.A.C. AND T.U.C.

SIR,—As an ordinary member of the British Association of Chemists, I was astonished to read Mr. Norman Sheldon's letter in your current issue denying that the Council of the Association sponsored the recent motion at the general meeting in favour of affiliating to the T.U.C.

The official report circulated to us with the ballot papers states: "Mr. D. Jackson, on behalf of the Executive Committee, then moved 'That the Council be authorised to apply for affiliation to the Trades Union Congress!'" Mr. Sheldon states that he "happened" (?) to be in the chair at this meeting and that he "made it clear that Mr. Jackson would not speak on behalf of the Executive Committee." There is no mention whatever in the report of this having been said. Why not? Surely it is most important if Mr. Sheldon is correct. But is he?

What is the real attitude of the B.A.C. Council to affiliation? Mr. Sheldon says it is neutral, but, on referring to the official report which was circulated, I find on pp. 2 to 6 a statement headed: "Report of Council on Affiliation to the T.U.C.," and it is stated that "This Report was adopted by the Council at its meeting on February 9, and ordered to be circulated to all members of the Association." The report is quite plainly in favour of affiliation to the T.U.C. and ends with these words: "In the light of the foregoing considerations, the Council has decided to secure the authority of the members of the Association for making our application for affiliation to the T.U.C."

If words mean anything at all, this means that the Council of the B.A.C. *did* sponsor the motion that Mr. Jackson proposed at the meeting. If this is not so, then I ask Mr. Sheldon to tell us: (1) Who did frame the motion in question?; and (2) Whether his letter in your columns represents his own personal opinion or whether it is an official pronouncement made on the authority of the Council or Executive of the Association? (If the latter, why is it not signed by the general secretary?)

The whole trouble with the B.A.C. for years has been its inability to exercise effective leadership among chemists. The result is that, on the one hand, the respectable, conservative Royal Institute of Chemistry has continued to recruit chemists so that its membership increased by 459 in 1945; while, on the other hand, the progressive left-wing Association of Scientific Workers continued to increase its membership and recruited 1138 new members in the first quarter of this year. But the B.A.C. membership figures have remained static for the past three years. The moral surely is, that plenty of people can be found to join any well-organised association which knows its own mind and knows where it is going, but that nobody can be found to join one which speaks with a multitude of conflicting voices and whose Council, apparently, just cannot make up its mind about anything.

Yours faithfully,

NON-SOCIALIST CHEMIST

August 24, 1946.

Walnut-Shell Powder

SIR,—Walnut-Shell powder from the U.S.A. contains about 50 per cent. cellulose, 29 per cent. lignin, 5 per cent. cutin, 9 per cent. furfural, 7 per cent. ethanol. The moisture is 6.70 per cent. In 100-mesh mixed with 80/90-mesh softwood woodflour it is a good filler for phenolic and cresylic synthetic resin moulding powders, giving a high lustre finish to the moulded product and helping to increase its dielectric strength. Also the presence of cutin helps to prevent water absorption, an important factor where hardness in the finished moulded product is required.

On account of the scarcity of the suitable softwood woodflour, this walnut-shell powder is being largely used now by firms making the above-mentioned powders in Australia and also the U.S.A., and if import licences are granted it will most probably be used by the English firms.

In 325-mesh it is a splendid extender for synthetic glues and in coarser grades it is used as a carrier for horticultural insecticides, also a producer of voids in fireclay bricks and high-temperature ceramics and gives good wearing surfaces in high-grade linoleum and magnesite jointless floorings.

Also in the manufacture of rubber and high-voltage insulative products it reduces weight, while increasing strength and wearing qualities.—Yours faithfully,

W S. DAHL.

London, W.14.

New Control Orders

Mercury

THE Control of Mercury (No. 12) (Revocation) Order, 1946 (S. R. & O. 1946, No. 1403), which came into force on August 23, revokes the Control of Mercury (No. 11) Order, 1945, and thereby removes the statutory maximum price control of mercury and mercurials.

Construction has started at Queen's University, Kingston, Ontario, Canada, of a new four-storey wing which is to provide additional space for undergraduate and research laboratories in chemistry and chemical engineering.

South African Chemical Notes

Shortage of Soaps and Paints

(from Our Cape Town Correspondent)

OWING to the acute world shortage of oils and fats—used in huge quantities by soap factories—soap is likely to be included among the articles rationed in the Union. With the exception of a small quantity of nut-oil produced in the Transvaal, all the ingredients for the manufacture of soap are imported, the main normal sources of supply being India, Sumatra, and Ceylon. Considerable supplies of oil were imported into the Union from India, but the serious famine there has compelled the Indian Government to divert these supplies to the manufacture of foodstuffs. Soap factories in the Union have been compelled to decrease their production during recent months, and now can supply only at the rate of half last year's requirements. The shortage of meat in the Union has made it impossible for soap manufacturers to obtain supplies of animal fats which are used on a big scale in the making of washing soaps. In addition, UNRRA has asked for huge supplies of fats and oils to feed the starving populations of Europe, and this has also affected local soap factories. The manager of a big soap concern said that factories in the Union are not likely to be forced to stop the manufacture of soap and that with less hoarding of supplies the essential demands of the public would be met.

War Against Insects

The arsenic-resistant tick that has threatened the coast belt of South Africa north and south of East London has been shown to fall an easy victim to Gammexane, probably one of the most powerful insecticides now in use in South Africa. The first small supplies reached this country in December, 1944, and were immeditely tested against the recalcitrant tick. The results were startling. A dilution of one part of Gammexane in 20,000 was effective against the tick, compared with a much higher concentration of DDT. All the research work in the Eastern Province has since been concentrated on Gammexane. Cattle are cleared of arsenic-resistant ticks in three or four weekly dippings. Thousands have been dipped without harm. Cattle have been dipped in drizzly weather and inspanned and worked immediately after dipping. Gammexane dips, in addition, have little or no effect on milk production. Extensive experiments in South America and Australia have confirmed this South African success.

The damage done by wood-boring insects has become so serious in the Union that experiments have had to be conducted with the object of defeating them. Now, after long and tedious operations, a powerful synthetic chemical has won the approval of the Forest Products Institute and the Division of Entomology. This chemical, P.C.P. (pentachlorophenol), is no new discovery, but it is only recently that it has been properly tested under South African conditions. The institute and the division have placed their seal of approval on the use of P C.P. solutions, summarising their findings by stating that it "ensures, by momentary immersion, a dry, clean, safe, economical, and certain protection against wood-destroying organisms," and, as a result of its use, the timber shortage has been rendered less acute.

Specially constructed smoke generators are being tested by experts at Onderstepoort in the campaign against nagana, a disease which has caused considerable stock losses in Natal and Zululand. The generators produce a thermal mixture containing DDT, which is driven off in the form of smoke for use against the flies which cannot be reached by other means. The Minister of Agriculture told a deputation from the Natal Agricultural Union that the Government regarded nagana as a national problem and was bearing all the expenses of the anti-nagana measures. All the farmers had been asked to pay for was the "1553" preparation which was being obtained from America for use against this scourge. The clearing of bush and aerial spraying had all been done at State expense. The deputation was also informed that Dr. G. de Kock, of Onderstepoort, would carry out an aerial survey of the Mkuzi Reserve in order to see how spraying could be extended. A two-mile trip would have to be cleared round the reserves and clearing would also be necessary inside the reserves.

The Paint Problem

Local paint firms predict that the shortage of basic pigments, now acute, will get worse before it gets better. Coupled with the need to repaint exteriors to preserve them from the weather is the desire on the part of property owners to refurbish their buildings for the Royal visit. "The biggest demand," according to the manager of a paint store, "is for whites and creams. But linseed oil, which cost 3s. 9d. a gallon in 1939, now sells at 14s. 6d. a gallon. White lead used to cost 6d. a pound. To-day—when one can buy it —it will cost 1s. 3d." Other materials, such as zinc oxide and lithopone, are scarce. Zinc oxide is often unobtainable in South Africa, but when supplies are available it sells at 150s. per cwt. Lithopone, once the cheapest base for paints, has risen 75 per cent. in

price and now sells at 997s. 6d. per cwt. As an alternative to the conventional white and cream fronts of buildings, property owners may decide to repaint in brighter hues, but paint firms do not expect that the main streets will suddenly break out in red and purple. The shortage of paint has increased the demand for whitewash, which is being more lavishly used than for a long time past.

Vermiculite

Since 1937 the Government Metallurgical Laboratory has interested itself in the examination of samples of vermiculite from the Palabora deposit in the Transvaal with a view to its possible economic development and use. Methods and processes used in other countries were examined and attention was directed to the production of commercial grades in South Africa. In consultation with leading experts and under the guidance of the Laboratory, commercial interests were able to determine the most suitable plant for pre-treating, cleaning, and exfoliating the ore. The entire field of vermiculite technology has been covered by a valuable bulletin issued by the Government Metallurgical Laboratory, which deals very fully with occurrence, working, uses, assaying, and testing of the mineral. It is considered that the most rapidly-growing and probably most important use of vermiculite from the point of view of South African consumption is as an aggregate in light-weight concrete, for which vermiculite appears to be a highly suitable material. In this connection it might be emphasised that the potential market for products of this nature should be limited only by the demand for houses (likely to be unlimited for many years to come) and the country's readiness to break away from traditional building practice and take advantage of new materials and methods to accelerate the programme.

The new £24,000 factory for Rely Paint & Metal Works, Paarden Eiland, Cape Town, has been officially opened. The company expects to double its present output when the new factory is in production. It recently completed an agreement with a leading U.S. paint combine to make their rubber-based "Insl-X" paints in South Africa under licence.

Metallisation S.A. (Pty.), Ltd., 48 Van Beek Street, New Doornfontein, Johannesburg, are now applying special rust-proof coatings of zinc to steel truck bodies. They claim that this method is most hygienic and has proved eminently successful when applied to trucks carrying meat.

From New York it is reported that the Buffalo Machine Company, of Buffalo, has applied for a patent for a device designed to produce combustible gas from a commercial type of atomic "C" uranium.

Synthetic Resin Mouldings

New British Standard

For some years there has been a British Standard Specification for synthetic resin moulding powders of the phenol formaldehyde type. A corresponding specification for the aminoplastic (urea) materials has now been issued as B.S. 1322: 1946, Synthetic Resin (Aminoplastic) Moulding Materials and Mouldings. This specification standardises the methods of test and provides the technical information necessary to frame purchasing specifications for aminoplastic moulding materials and mouldings.

The specification defines two types of material according to their properties, and further types will be included later enabling a purchaser who requires material or mouldings for a particular purpose either to quote B.S. 1322 or, alternatively, to build a specification for a special type of aminoplastic material or moulding, by fixing a special standard of performance and prescribing the standard tests. The methods of test included in this specification are based on experimental work carried out by the British Electrical and Allied Industries Research Association, the British Plastics Federation, the General Post Office, and other industrial and Government laboratories. Copies of this specification may be had from the B.S.I., 28 Victoria Street, London, S.W.1, price 2s.

Chemical Exports

July Figures Show Big Increase

A gratifying increase in the exports of chemicals, drugs, dyes and colours from the U.K. is shown in the Board of Trade monthly accounts for July.

The total value for the month is given as £6,471,353, which is an increase of £2,031,777 over the figure for June, £3,863,344 over the figure for July last year, and £4,614,704 over the monthly average for 1938. British India continues to be the biggest customer, her purchases during July totalling £1,657,329, followed by Australia (£1,210,771), and the Union of South Africa (£1,029,448).

Imports of chemicals, drugs, dyes and colours into the U.K. during July again showed a decline. The total value is given as £1,353,191, which is £52,237 less than the total for June, £1,830,794 less than the figure for July last year, and £218,800 less than the monthly average for 1938. The largest supplier during July was the U.S.A., with goods valued at £435,863; Canada was second (£165,439); and Spain third (£151,910).

Thorium Reclamation

Recovery from Gas-Mantle Residues

by A. G. AREND

THE extraction and refining of thorium is one of the more complicated branches of the rare metal industry because of the presence of so many other constituents and rare products in greater or lesser quantity. Unlike uranium, an associated radioactive metal, the separations are more involved (at least, as a general rule), and although detection can be made by observing the feeble radioactivity exhibited, actual identification cannot be confirmed in the easy way possible with uranium. The fact that uranium possesses a soluble carbonate simplifies discrimination, and when to this is added the existence of a hydrate, which, unlike those of the alkali metals, is insoluble, and which is produced as a distinctive yellow precipitate, it becomes one of the simplest metals to test for. The same, however, cannot be said of thorium. To-day, nevertheless, its separation has been assisted by the introduction of a number of specialised precipitation reagents, instead of depending on the somewhat crcuitous iodate method. The latter could reveal the presence of 0.0002 per cent. of thorium, but, of course, necessitated the services of a regular laboratory lay-out, apparatus, equipment, etc. Details of the tests have appeared elsewhere, and need not be repeated.

Thorium has gained some importance recently in view of the development of nuclear researches, where the splitting of its nucleus is limited to fast neutrons, an operation which is at present under close scrutiny. Whereas hitherto no really successful industrial application has been found for uranium, with the exception of its use as a catalyst, thorium enjoyed great popularity even in earlier years for the production of incandescent mantles, as well as for similar catalyst uses, and for medicinal and scientific investigations.

Wide Distribution

Thorium is widely distributed, as a reference to numerous geological and mineralogical papers will reveal. It exists in various Norwegian granites, in different limestones, and dolomites, and in fluorspar, and, in this country, has appeared in certain areas in Scotland. While its main sources are monazite, and the less common thorite and thorianite commercial ores, Vesuvian lava, and a number of other lavas show evidence of its presence. As some of the available material is in one form or another of infusible silicates, the initial opening-up of these offers difficulties unknown with the more soluble varieties of ore, but hydrofluoric acid solvent solutions, using lead receptacles, have gained some popularity. The difficulty of acquiring a relatively cheap source of thorium for scientific investigation led to some unique experiences. Despite the care which is bestowed on the packing of incandescent gas mantles, consignments of these have been damaged in transit, and rendered worthless. Acquisition of these broken mantles was undertaken by a Glasgow firm a number of years ago, and although the source was an uncertain one, it provided a sufficiency of thorium for the purposes on hand. Unlike the regular ore extraction process, the residue from the broken mantles furnished a material which, despite the fact that the fabric had only been immersed in a solution of the rare earth salts, was more concentrated than many of the ores worked.

Regular Extraction Process

So far as the regular ores, such as monazite sand, are concerned, the concentration is initially complicated by the fact that there are particles to contend with which, although small, have a relatively high specific gravity, and larger particles of low density. Shaking and jigging on mechanical tables operated in different ways produced unexpected hazards, and the electro-magnetic method tended to oust the other alternative of air-flotation. To-day, both these latter methods have been improved on, and the concentration is continued until some 90 per cent. of monazite is obtained from the associated sand. The monazite itself can contain anything from 2 to 14 per cent. of thoria, according to whether it hails from Brazil, Travancore, or the U.S.A.

Electro-magnetic separation has been expedited by the use of more magnets spaced to deal rapidly with each lot as the material flows along a continuous conveyor belt. The discharge is made into various bins, and the process repeated several times, and, with good working, a 95 per cent. concentrate has been reached.

Air-flotation has likewise been speeded up by the use of improved blowers, balloon collectors, and intermediate curved channels, but it would appear that the combined employment of both systems holds the greatest advantage. Unlike the slower fusion processes, or methods of dissolving in hydrofluoric acid (which are unduly costly), the concentrate alike from these sands, and from limestone, and dolomite, allows of direct solution by digestion in concentrated sulphuric acid. The plant used comprises a

Fig. 1. Working a monazite deposit in Travancore State, South India.

battery of cast-iron pans, care being taken to see that no moisture can get access to these, as diluted acid would soon make an inroad and seriously corrode the metal. This measure obviates the use of the more costly silicon-irons, or alloy steel containers. One of the practical troubles is the "bumping" of the syrupy liquors as the mass becomes pasty. Special pans have been designed which tend to offset this bumping difficulty, but have not apparently been used in thorium extraction, and a closed vat with stirrer device is persevered with, using a ceramic take-off to remove obnoxious fumes, and a settling-bend where dissipated liquid particles collect. Sulphuric acid of 76.7 per cent. concentration is first placed in the pan, and raised almost to boiling point, while a stream of the concentrates is allowed to flow in at interrupted intervals, until the ratio is of the order of one of solids to two of liquid Gas burners are used as the source of heat, and a sump is provided beneath them in case of contingencies such as a break-away of the liquor, with a pan cracking; although this occurrence is somewhat rare, it nevertheless caused coal-firing to be abandoned.

In the process of recovering thorium from broken gas-mantle accumulation, as shown in the accompanying flow-sheet, the same method is followed up to this point, but the difficulties are less numerous, as there are no rare-earth phosphates to contend with The process, however, is not to be regarded as simple, for a number of other rare constituents have to be separated, and what is worse, the original thoria used is rarely perfectly pure to begin with. Translation of heat into light with pure thoria is actually less than with the impure or commercial material as distinct from other oxides. The relative values of this have been worked out in detail, and show pure thoria at 0.5 and the commercial at 6.0 in light-emitting power, whereas zirconia is less markedly influenced. It is the presence of the added impurities which give the full light power, and hence there is no need to purify the initially obtained thoria.

The manufacturing process of the gas-mantle is well known, and it transpires that the Welsbach's original mixture has never been improved on. Woven cotton or artificial silk fabrics are used for the impregnation, and the more recent rayon fabrics have also been tried out, despite the encroachment of electricity on gas lighting To save

time, the consignment of damaged mantles, with their cardboard or paper packagings, are first emptied *in toto* into an oven and burned, and by applying a current of air, all light-weight matter is removed to a collecting receptacle, leaving behind the ceramic rings. This light mass requires an oxidising treatment to burn off all free carbon, and as stirring is prohibited, this is a lengthy process. The product so obtained compares with monazite concentrates except that it is free from phosphates and other deleterious matter. The fine material is first sprinkled with water before opening the oven, when a damp greyish mass is removed, suitable for the same treatment as before. It was found that an initial fusion with soda rendered the mass more amenable to solution in sulphuric acid, which was applied as described.

The solution contains small percentages of cerium, beryllium, and magnesium, besides its main constituent thorium, but the presence of undecomposed carbon particles causes the separation of more than the usual amount of free sulphur from the sulphuric acid. The original solution used for impregnation contains a mixture of 100 parts of thorium nitrate (containing from 48 to 49 per cent. thoria), 10 parts cerium nitrate, 5 parts beryllium nitrate, and 1.5 parts magnesium nitrate. Beryllium and magnesium nitrates are added chiefly to strengthen the ash skeletons of the mantles, while the light-emitting power of the latter principally comes from the thoria-ceria mixture. It will thus be seen that despite the small additions made to the fabric, when once the latter has been almost completely burned off and separated by air-flotation the final ash concentration is largely composed of thoria; but it requires accumulations of thousands of damaged mantles to give an appreciable amount.

Before the war, thoria was quoted at 40s. per oz., and hence allowed a fair margin for outlay (besides also being difficult to procure), and it was this feature which gave the incentive to recover it. Not a little of the success depends on the initial burning, first to remove the collodion, and paper, etc., and finally to get rid of the adhering carbon particles, but the total weight obtained is still surprisingly small. The same burning transforms the nitrates into oxides which slowly dissolve in the acid mentioned. (An alternative method of drawing the material into solution is by first fusing with sodium hydrosulphate when it is rendered soluble in water.)

As salts of zirconium and a number of adulterants may be present, besides the small addition of magnesium, the familiar oxalic acid precipitation is initially used, but this means that cerium is simultaneously deposited. Sufficient water is added to form a 15 per cent. acid solution, and the precipi-

Thorium Reclamation Flow-Sheet

Gas mantle residues heated with sodium hydrate, alkali washed out, and residue digested in hot concentrated sulphuric acid, filtered, and washed.

Filtrate made 15 per cent. acid, and oxalic acid added, settled 24 hours, filtered, and washed. (This separates most common metals, and also zirconium, from the thorium).

Precipitate dissolved in concentrated ammonium carbonate solution, the liquor neutralised, made to contain 10 per cent., ammonium nitrate, and 3 per cent. hydrogen peroxide, while maintained at between 60° and 80° C., filtered, and washed. (Precipitate may still contain traces of cerium).

Wet residue dissolved in 10 per cent. hydrochloric acid, boiled with potassium azide, and the precipitate filtered, washed, dried, and ignited in crucible to give pure thoria.

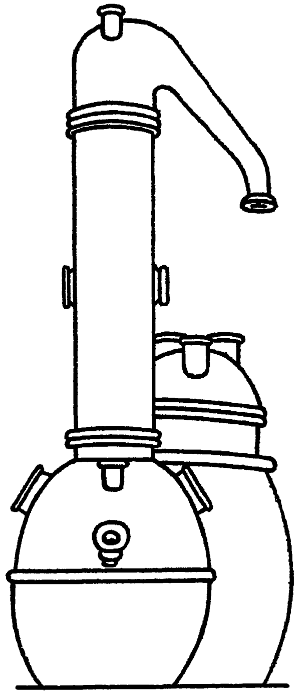

Fig. 2. For laboratory work, initial digestion of the residues is carried out in earthenware vessels with tubular device to avoid losses by splitting, but on the large-scale closed iron pans with stirrer are necessary to minimise bumping.

tate allowed to stand 24 hours prior to filtering. This precipitate is dissolved with as concentrated a solution of ammonium carbonate as can be obtained, with the addition of sufficient ammonia to form the normal salt.

The earlier methods, with the exception of the slower iodate process, could not be depended on for large-scale recovery, and such recovery was found to be unduly expensive, particularly as the process had to be repeated several times. For this reason, a crude gelatinous precipitate of thorium hydrate is first prepared by treating the neutral solution containing 10 per cent. ammonium nitrate, with 3 per cent. hydrogen peroxide at between 60° and 80°C. This method separates the thorium from practically the entire cerium, beryllium, and other rare metals present, but is not fool-proof. Care must be taken not to dry the precipitate as it can be rendered very resistant to solution in acids, and while still wet is dissolved in hydrochloric acid (10 per cent. solution), and boiled with potassium azide, which latter method has been found to be most reliable. The precipitate obtained is simply ignited in a crucible to a dense white powder, or pure thoria.

Concluding Notes

A number of special practical difficulties arise in connection with thorium products, particularly with the hydrate, which if not dissolved instantly according to its condition, can form an opalescent solution, which, so far from dissolving to a clear liquid, coagulates with the acid. So far as mantle residues are concerned, the cerium beryllium, and zirconia or other rare earth oxides included are not usually present in sufficient quantity to justify reclamation. Particulars of the radioactivity of thorium, the light-emitting power of its oxide, and characteristics of other salts have appeared in detail elsewhere, and need not be repeated.

The main sale of the mineral is in the form of the dioxide or thoria, which is to-day used as a catalytic agent, for searchlights, for improved flashlights, in the heating filaments of certain electric lamps, as a screen for "X" rays, and in a number of specialised scientific investigations.

German Technical Reports

Latest Publications

SOME of the latest technical reports from the Intelligence Committees in Germany are detailed below. Copies are obtainable from H.M. Stationery Office at the prices stated.

CIOS XXXIII—32. The Vereinigte Leightmetall-Werke, Hanover: Aluminium and magnesium base alloy foundry, processes and production (3s. 6d.).

CIOS XXXIII—40. Gelsenkirchner Bergwerks A.G.: Nordstern coke-oven plant (1s.).

FIAT 501. *German aluminium and magnesium industries* (10s. 6d.).

Research Laboratories

Ashmore Benson and Pease's New Premises

A LARGE and representative gathering of friends and officials attended the Stockton-on-Tees works of Ashmore, Benson, Pease & Co., Ltd., and the Power-Gas Corporation, Ltd., on the occasion of the inaugural opening of new research laboratories on August 23

The ceremony was performed by the Mayor of Stockton-on-Tees, Alderman Alex Ross, who was accompanied by members of the Stockton Corporation Industrial Development Committee. In commending the firms upon their enterprise and expansion of the laboratories and works, the Mayor mentioned that they were well-known as being among the foremost and largest concerns with a world-wide reputation for the design and supply of plant and equipment for the chemical, gas, and iron and steel industries. He pointed out that the laboratories were equipped not only to serve clients who were installing plant of this description, but also for the purpose of investigating new processes in which they as manufacturing and general contracting engineers became interested.

After an inspection of the laboratories and tour of the works, the party was entertained to tea by the managing director, Mr. N. E. Rambush, and executives of the companies.

HIGH POLYMERS

The London Section of the Oil and Colour Chemists' Association announces that the sixth series of post-graduate lectures will be entitled "The Chemistry of High Polymers" and will be delivered by Professor H. W. Melville, D.Sc., F.R.S. (Professor of Chemistry, Marischal College, University of Aberdeen), in the lecture theatre of the Royal Institution, 21 Albemarle Street, London, W.1, on the following Thursdays: October 3, 10 and 17, at 6.30 p.m. The syllabus will be as follows: Lecture 1, Synthesis; Lecture 2, Molecular Size; Lecture 3, Molecular Structure. An inclusive charge of 10s. for the three lectures will be made to members and visitors. Admission will be by ticket only and applications for tickets, accompanied by remittances, must be sent to the hon. secretary, Mr. David E. Roe, c/o Atlas Preservative Co., Ltd., Fraser Road, Erith, Kent.

Personal Notes

Lieut.-Col. A. M. Weber-Brown, M.V.O., has been appointed a director of the London Tin Corporation.

Dr. A. E. Dunstan has been appointed to represent the Institute of Petroleum on the Royal Society's Committee on Chemistry.

Dr. R. N. Jones of the Department of Chemistry, Queen's University, Kingston, Ontario, has accepted an appointment as associate research chemist at the Canadian National Research Laboratories, Ottawa.

Mr. Arthur Whiteley, managing director of the Glanmor Foundry Co., Ltd., and its associate, Thomas & Clement, Ltd., iron founders, both of Llanelly, has accepted an invitation from the Government to be the controller of all the foundries in the British zone of Germany, which employ nearly 500,000 people.

Mr. Frank Smith has been appointed sales executive of the Dunlop Rubber Company with particular responsibility for sales administration and co-ordination of the company's many distributive divisions. During his 31 years with the company, Mr. Smith has held important appointments in London and Birmingham. His future office will be at the Dunlop administrative headquarters in London.

Professor Douglas Hay, M.C., B.Sc., M.Inst.C.E., has been appointed chief mining engineer to the National Coal Board. He will take up his appointment at an early date. Professor Hay is president of the Institution of Mining Engineers and hon. professor of mining, Sheffield University. He is at present managing director of Barrow Barnsley Main Collieries, Ltd., and the Barnsley District Coking Co., Ltd., also technical director of the Wombwell Main Co., Ltd. He has been consulting engineer on ventilation of the Mersey Tunnel (1929-37) and Dartford Tunnel since 1937.

Chemical Research

Success of Austrian Experiments

According to the Directorate of Information Services, Control Office for Germany and Austria, Treibacher Chemische Werke is carrying out experiments for the production of sodium bichromate and potassium bichromate. Laboratory results are so far satisfactory, and it remains to be seen whether the furnaces and mills prove adequate for this work, in which case production on a commercial scale could start at short notice.

Treibach is also experimenting with water-glass and has successfully produced solid water-glass, 1500 kilogrammes having been delivered to the Bleiberger Bergwerks Union for use with their molybdenum flotation plant. It is reported that results were satisfactory and commercial production of solid waterglass can begin, provided sufficient quantities of quartz sand and soda are available. Production of water-glass solumnion has not been so successful owing to lack of suitable apparatus, but it is considered that this difficulty will be shortly overcome.

Welding of Light Alloys

Forthcoming B.W.R.A. Symposium

A symposium on the welding of light alloys is being organised by the British Welding Research Association. It is to be held on Wednesday and Thursday, October 16-17, in the Henry Jarvis Hall of the Royal Institute of British Architects, 66, Portland Place, London, W.1. The programme will include four sessions dealing with: (1) development of high-strength aluminium alloys for welding; (2) pressure welding and flash welding of light alloys; (3) spot welding of light alloys; and (4) welding of magnesium alloys.

Demonstrations and exhibits will be arranged at the offices of the Association at 29 Park Crescent, a few minutes' walk from the lecture hall. Although accommodation will be limited, a certain number of tickets will be available and application should be made to the British Welding Research Association, 29 Park Crescent, London, W.1

Iron and Steel Output

U.K. Figures for July

According to figures issued by the Ministry of Supply (Iron and Steel Control), the U.K. production of pig-iron and steel during the first two quarters of this year and during the month of July was as follows, the figures given representing tons:

Pig Iron

	Weekly Average	*Annual Rate*
1st Quarter	145,500	7,566,000
2nd Quarter	150,500	7,827,000
July	147,000	7,645,000

Steel Ingots and Castings

	Weekly Average	*Annual Rate*
1st Quarter	242,600	12,617,000
2nd Quarter	252,100	13,111,000
July	226,000	11,750,000

Stock tin ore (tin content) in United Kingdom, January 1, 1946, 7322 tons, and on July 1, 1946, 7753 tons.

A CHEMIST'S BOOKSHELF

JOURNAL OF THE ELECTRODEPOSITORS' TECHNICAL SOCIETY (Vol. XX, 1944-45). London: Electrodepositors' Technical Society. Price (to non-members) 21s.

The latest volume of this Society's journal maintains the high standard set in previous issues. This is the only technical society in Britain concerned with the electrodeposition industries, and serves as a useful forum for the presentation of papers and the discussion of current trends and problems in the industries. Much credit is due to the officers of the society, and to the editor (Dr. S. Wernick) for the work they have done in the prompt production of the useful annual volumes throughout the war years. As would be expected, the majority of the papers in the current volume relate to methods of production, and problems immediately concerned with the production of munitions, but solutions found for war-time problems often result in improved methods, lower costs, and speedier output for peace-time application.

Four papers in this volume emanate from the Armament Research Department of the Ministry of Supply, Mr. A. W. Hothersall and Dr. G. E. Gardam of that department being old and tried supporters of the society. Two of the papers comprise work carried out some time ago but only now released for publication. The production of copper powder by electrodeposition is discussed by Mr. Hothersall and Dr. Gardam, who determined the appropriate conditions of operation and the plant required for a pilot-plant to produce 1 lb. of powder per hour. Production of metal powders by electrodeposition is a matter of some interest in view of the rapidly increasing ramifications of powder metallurgy. (Some of the aspects of powder metallurgy are described briefly in another paper in this volume by Mr. G. H. S. Price, of the G.E.C. Research Laboratories). Dr. Gardam reports an investigation to obtain a machinable deposit of chromium for a specialised purpose. Of the remaining two papers from the Armament Research Department, that dealing with the chromate passivation of zinc plate by Dr. S. G. Clarke and Mr. J. F. Andrew is a valuable contribution to the knowledge of a new process which assumed considerable importance in the production of zinc-plated weapons for the war in the Far East. This process, on which little real scientific data have hitherto been available, has a proved value for preserving zinc plate under very damp and humid conditions. Finally, Mr. E. Spencer-Timms describes a newly-developed magnetic tester for determining the thickness of electrodeposited coatings on a steel base. While the instrument has certain limitations, it is a useful addition to the limited number of ways of testing the thickness of a deposit quickly and non-destructively.

Two papers describe the application of electrodeposition to the production of bearings for aircraft engines. Mr. O. Wright reports that electrodeposited lead bearings, only 0.0005 in. to 0.001 in thick, have proved highly satisfactory even after 600 hours' operational flying on an engine with the highest bearing load per sq. in. of any aero-engine in the world. Silver bearings have also proved particularly suitable for heavy-duty bearings in aircraft engines, as they have a high resistance to corrosion by oxidised oils and good seizure resistance. According to Mr. Sprague's work a very thin undercoating of nickel and copper is required with a top coat of silver 0.002-in. thick.

On the engineering aspect of the processes, Dr. Jevons discusses pressing technique as a preliminary to the production of good deposits. In view of the tremendously wide field of application of metal pressings in modern industrial practice, this paper is a useful summary of the defects which may arise in the plated metal surface owing to inherent faults in the metal or to bad pressing technique. A new plant for the continuous electroplating of wire is described by Dr. J. Kronsbein and Mr. A. Smart. This new design is claimed to eliminate the disadvantages of former continuous wire-plating plants, namely, the excessive floor space and the limited current carried by the wire above the surface of the liquid.

Other related subjects of interest include the production of "black finishes" on steel by Mr. H. Silman; the increased resistance to corrosion conferred by an undercoat of tin in composite tin/zinc and tin/cadmium deposits by Dr. S. Warnick, and the effects of the presence of sulphate on the anodic film on aluminium, by Mr. D. Jackson. Mr. H. D. Hughes gives a useful account of a recently-developed method (electrography) for examining electrodeposits. This may be applied first, for reasonably quick and certain identification of the metal coating, and second, for the examination for defects, mainly porosity. This represents a further method of non-destructive testing of deposits and is of value on that account.

The recorded discussions are lively and full of practical suggestions and criticisms. This is a valuable addition to the series of annual volumes.

RECENT PROGRESS IN SYNTHETIC RESIN FINISHES AND ENAMELS and RECENT PROGRESS IN ELECTROPLATING AND METAL FINISHING. London: Hood-Pearsons Publications, Ltd. Pp. 52 and 48. 3s. 6d. each.

These two booklets, the first of the publishers' "Technical Progress" series, both draw largely on previously published work

in German sources, the first being composed almost entirely of translations of German papers or excerpts from recent books.

The first two chapters of Booklet No. 1 give a general impression of vagueness coupled with a notable absence of "hard" data. Probably much more valuable work along the same lines could be produced by correlating the data from the appropriate CIOS, BIOS, and FIAT reports now appearing. As a result of this absence of "hard" data the booklet suffers a double disadvantage in that it is not of sufficient value to the chemist or research worker, while it is too technical to appeal to the foreman plater or charge-hand operator. Chapter 3, dealing with the preparation of the fatty acid (oil) modified alkyd resins, is merely a summary of existing patents, but it does include a full bibliography. The last chapter presents in a more interesting fashion some recent developments in the application of pre-applied organic finishes before cold-drawing. It is interesting to learn that one or more undercoats of organic resins may be applied to steel or other metal sheet before cold-drawing, and that tin containers for food are manufactured in this manner without apparently any necessity for lacquering after the tin has been formed. A similar procedure may also be applied in the production of motor-car body and wing pressings, thus effecting considerable savings in labour and production costs.

Booklet No. 2 is a much more practical publication designed to appeal to the works chemist or foreman in a plating shop. It is well equipped with useful practical data relating to bath compositions and operating conditions in the plating shop. Chapters 1-4 are devoted largely to a discussion of the newer "bright" plating processes, while there are some helpful data on the use of the "organic brighteners," and a note on the attendant possibilities and dangers in operation. The production of "bright" deposits of the important metals—nickel, zinc, cadmium, and chromium—is quite well covered, but more could have been said on "bright" brass plating and alloy plating generally. The last chapter contains a useful summary of the available data on the effect of the phosphatic coatings (produced chemically, not electrolytically) in facilitating deep-drawing of metal sheet. The application of this phosphatising process to the treatment of pistons and piston-rings opens up some interesting possibilities.

EXPERIMENTAL PLASTICS AND SYNTHETIC RESINS. By G. F. D'Alelio, A.B., Ph.D. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Pp. 185. 18s.

Ninety-seven experiments and twenty-seven test methods demonstrate the chemical reactions used in the preparation of plastic materials. Included in this unique book are the essential principles and laws governing the important industrial plastics of to-day. The book is suitable both in the training of students and for laboratory use, and is intended to supply the members of college and university staffs with techniques and processes which could be used as part of a laboratory course in plastics. Since many of the highly successful war applications of plastics were the result of joint efforts by industry and research, it is fitting that industry and research should work hand in hand to promote plastics as a branch of science. This text-book deals with practically all the well-known resins and plastics which can be prepared readily, even in a small laboratory, and the questions set after each experiment will provide a most valuable part of a student's training. Formulas and figures complete a well-designed and executed scheme for a thorough grasp of the most important thermosetting and thermoplastic materials. An appendix contains a list of industrial supplies suitable for use in the experiments of this manual, of importance chiefly for the American processor. The absence of advertising matter is a distinct advantage in comparison with many publications on plastics, and this maintains the level of the book as a scientific contribution.

Swedish Chemists

British Works and Institutions Visited

TWO professors and twenty-six students of chemistry from Sweden spent several weeks during August in the Sheffield and Manchester areas visiting chemical works and institutions. The arrangements were made by the British Council.

While in Sheffield they visited the I.C.I. works at Billingham; the Department of Glass Technology at Sheffield University; Newton, Chambers & Co., Ltd.; Southwood Ovens high temperature carbonisation plant; the Research and Development Department of the United Steel Co.'s Stockbridge Works; the carbonising plant of the Derbyshire Coalite Co., and the refinery of the British Diesel Oil and Petrol Co. at Bolsover.

In the Manchester area the party went to the Walmapur Co.'s works at Darwen; the Manchester Oil Refinery at Trafford Park; Messrs. Pilkington Brothers' glass factory; the soap and chemical works of Jos. Crosfield & Sons, at Warrington; the I.C.I. dyestuffs division and works at Blackley; the Shirley Institute, Didsbury; the Chorley Bleaching Co.; Partington Gas Works; Lever Brothers' soap factory at Port Sunlight; the United Alkali Co., Widnes; and the alkali division of I.C.I. at Winnington.

Phthalic Anhydride from Xylene

American Process

SOME details of the process developed in the U.S. for the commercial production of phthalic anhydride from petroleum *ortho*-xylene instead of from naphthalene are given in *Chemical Industries* (1946, *59*, 68). The plant operating the process, the first of its kind, was built by the Standard Oil Company of California for its subsidiary, the Oronite Chemical Company, at the cost of \$1½ million and was completed at the end of 1945. Its capacity is 3500-4000 tons per annum, about 5 per cent. of the national total. Until the construction of this plant, naphthalene was the sole raw material for the commercial production of the anhydride. The process employed is basically the same: catalytic vapour-phase oxidation over a vanadium-based catalyst.

Source of Xylene

The *o*-xylene for the process is produced as a petroleum by-product with a purity ranging from 85 to 90 per cent. The plant for the preparation of the *o*-xylene from the crude xylene cut was originally erected for the production of toluene during the war, but has since been converted for the separation of this material. The *o*-xylene is fed from two 20,000-gallon tanks through a steam-heated vaporiser by individual gear pumps to eight identical process units where it is injected into the heated air stream at approximately atmospheric pressure. The air is supplied for this part of the process by two compressors running in parallel at 7600 r.p.m.

The ratio of air to hydrocarbon as it enters the converter is dictated by the explosive limit of the mixture and is kept on the lean side to prevent the possibility of an excessive temperature rise which would result from an insufficient ratio of air to feed. This mixture is fed through a multiple-tube converter where the anhydride is formed.

The converter consists of a bundle of tubes, catalyst-filled, cooled by a circulating bath of molten salt, which holds the temperature of the catalyst above 540° C. Heat is removed from the cooling medium by passing it through a waste heat boiler for steam generation. The time of contact with the fixed-bed catalyst, which is vanadium-based as in naphthalene oxidation, is less than one second.

The product from the converters is passed through coolers before entering the five large box-like condensers where the long white to tan straw-like crystals form on the side walls. These crystals fall into tapered bins from which they are collected. The waste gases from the converter are collected in a stack and burned.

On a weight basis the actual yield of phthalic anhydride from *o*-xylene is over 70 per cent., comparing favourably with that from naphthalene. The theoretical yield from pure *o*-xylene is 140 per cent., as compared with 116 per cent. from naphthalene Carbon dioxide is the principal by-product of the oxidation process, although in some naphthalene conversions appreciable amounts of carbon monoxide are produced.

The crude crystals are periodically removed from the condenser boxes and transferred to an underground melt tank where closed steam coils are used for its liquefaction. The resultant molten material is then pumped to the first of the two distillation columns, which are operated in series. The centre cut from the first still passes to the second, from which the purified product is removed to an aluminium storage tank. The bottoms and heads from the first still are returned for reworking.

The still molten anhydride is then fed from the aluminium storage tank to a water-cooled stainless-steel drum on which it solidifies. A doctor-knive shaves the pure white solid from the drum, the flakes dropping into an automatic weighing machine for packaging.

With the purpose of giving some information about the firm for the benefit of intending apprentices, W. C. Holmes & Co., Ltd., chemical engineers, Huddersfield, have issued a well-produced brochure, "The Training of an Engineer," which should meet a real need. Special sections deal with works training, technical training and additional training.

A material which has suffered overmuch in the past from lack of standardisation of quality is that familiar laboratory reagent, soda-lime (sodium calcium hydrate). Commercial samples have varied greatly in their efficiency as absorbents for carbon dioxide and other acid gases. Consequently, by using strict laboratory control, SOFNOL, LTD., Westcombe Hill, Greenwich, S.W.10, have good grounds for their claim that their product, "Sofnol non-hygroscopic soda-lime" is the most efficient carbon-dioxide absorbent yet discovered. A new section of their catalogue (SO-646), dealing with this product, gives physical data about it, together with specifications of the types of material available, and is illustrated with three boldly effective graphs.

General News—From Week to Week

The telephone service with Iceland has been reopened and the charge for a three-minute call is 24s.

After being in consultation with the Government here for several weeks, Dr. H. J. van der Bijl, chairman of the South African Iron and Steel Industrial Corporation, has returned to Johannesburg.

To give members an opportunity of securing their own hotel accommodation in London, preliminary notice has been circulated of the autumn meetings in London of the Refractory Materials and Building Materials Sections of the British Ceramic Society.

North London Branch members of the Institute of Welding are being invited to inform the hon. secretary, Dr. E. Sharratt, B.Sc., Ph.D., by October 1, whether they would support a proposed dinner-dance next April.

A £644,000 contract for the extension of the South African Iron and Steel Industrial Corporation's coke oven plant at Pretoria has been secured by the Woodhall-Duckham Vertical Retort and Oven Construction Co. (1920), Ltd.

Government purchase of tungsten and molybdenum ores and concentrates with the exception of small outstanding commitments has ceased, and it has been decided to return to private trading in these materials, according to the Ministry of Supply.

Under a contract for the delivery to the Ministry of Supply of 215,000 metric tons of aluminium from Canada during 1946-7, the first shipment, consisting of about 16,000 long tons, worth about £1,500,000, has now reached this country.

A chemistry sub-section will be included in an exhibition of more than 1,200 modern British books, which is to be opened in Berne on September 3, under the auspices of the British Council, and will later be shown in Basle, Zurich, Geneva and Lausanne.

A new DTD Specification, No. 758, has been issued for copper naphthenate, and is obtainable from H.M. Stationery Office (6d.). Further revised specifications dealing with magnesium alloy castings are Nos. 59B, 140B, 285A and 350A (1s. each), superseding 59A, 140A, 285 and 350 respectively.

At an extraordinary meeting of Metal Industries, Ltd., to be held immediately before the general meeting in Glasgow on September 12, a resolution increasing the maximum number of directors will be submitted. If it is passed, Mr. J. H. Enion will be proposed as additional director.

The July issue of the *Journal of the Textile Institute,* just published, contains an account of the proceedings at the annual conference, held at Scarborough in June, together with an appeal to members to raise £50,000 and to help towards a total membership of 10,000 as part of the Institute's special effort to improve and extend its usefulness.

The Minister of Fuel told members of the Scottish Regional Fuel Efficiency Committee at Glasgow that he would "rather spend £100,000,000 on research into devices for utilisation of coal waste than on the reorganisation of a great industry. There are some in the Government," he said, "who are wholeheartedly in support of desires expressed by research workers in every field of industry, and I believe that the money will be forthcoming."

By invitation of the Netherlands National Committee, the Fuel Economy Conference of the World Power Conference will be held at The Hague, Holland, on September 2-10, 1947. During the conference, an official visit of two days will take place to the Netherlands State Coal Mines, Lutterade. Intending participants from Great Britain are invited to apply for further particulars to: British National Committee, World Power Conference, 36, Kingsway, London, W.C.2.

At the annual meeting of Goodlass Wall and Lead Industries, Ltd., the chairman, Mr. Clive Cookson, advocated the reopening of the London Metal Exchange, in order to minimise the fluctuation of prices and to enable lead consumers to obtain lead at any time at the world price. At the same time, he spoke of the great skill with which the lead supply had been handled throughout the war by the Ministry of Supply, and forecast that, owing to the shortage of lead, Government control must continue to operate for some time.

Foreign News

The Dominion Tar and Chemical Company has offered a graduate fellowship of $800 in organic chemical research for the academic year of 1946-1947 at the University of Toronto.

Monsanto Chemical Company has succeeded in synthesising caffeine, and is erecting a $1,500,000 plant for the process at St. Louis. This would appear to be the first instance where so complicated a molecule as caffeine (mol. wt. 194) has been synthesised from its ultimate components, hydrogen from water and nitrogen from air, and is an important research achievement.

The Czechoslovak economic authorities are reported to be considering the establishment of a chemical industry in the eastern part of Slovakia.

Austrian iron production has been re-started with consent of the British Civil Administration for Styria. In Donawitz the first blast furnaece was put into action, with a daily production of 450 tons pig-iron. The monthly production of the Donawitz area will be raised to 60,000 tons of iron ore from the Erzberg mines and 6000 tons steel from five Siemens-Martin converters.

Washington announces that several non-ferrous metals, including cadmium and bismuth and their alloys, have been suspended from price control. The items covered are used for the most part for industrial purposes and represent but a small part of the cost of the industries in which they are used and the supply is at present greater than demand.

Hexaethyl tetraphosphate, a contact insecticide developed by the Germans during the war, is now being produced in the U.S. by the Monsanto Chemical Company. Though not yet thoroughly tested, it is believed to be efficacious against plant aphids and mites which are immune to DDT, and it is proposed to use it as a supplement to nicotine sulphate in dusts or sprays.

Forthcoming Events

September 10-11. Institute of Metals (Autumn Meeting). Institution of Civil Engineers, Great George Street, London, S.W.1. September 10, 2.30 p.m.: Official business, followed by three papers. September 11, 10 a.m.: Simultaneous groups of papers (in Lecture Hall and South Reading Room); 1.15 p.m., Annual luncheon at Connaught Rooms, Great Queen Street, W.C.2. Applications to the Secretary not later than September 1.

September 11. British Association of Chemists. Gas Industry House, 1 Grosvenor Place, London, S.W.1, 7 p.m. Mr. J. S. Evans, B.A., B.Sc. (H.M. Inspector of Factories, Engineering and Chemical Branch): " The Factory Acts as They Affect Chemists."

September 11. Institute of Welding (North London Branch). The Fyvie Hall of The Polytechnic, Regent Street, London, W.1, 7.30 p.m. T. J. Palmer: " The Weldability of Malleable Cast Iron."

September 16-19. Association of Tar Distillers. Programme of meetings at Queen's Hotel, Leeds, 1: September 16, 6 p.m., National Pitch Committee; September 17, 10 a.m., National Creosote Executive Committee, 2.15 p.m., A.T.D. Executive Committee; September 18, 9.30 a.m., A.T.D. Naphthalene Refiners, 10.30 a.m., A.T.D. general meeting, 2.15 p.m. National Creosote Committee, 4 p.m., B.R.T.A. Managing Council; September 19, 9.30 a.m., Pitch Marketing Company and Pitch Supply Association.

September 23-28. Welsh Industries Fair. Drill Hall, Cardiff, 11 a.m.-6 p.m.

September 26-27. Council of Industrial Design and Federation of British Industries. Central Hall, Westminster, London, 10 a.m. Conference on " Design," in association with the " Britain Can Make It " Exhibition.

Company News

The British Oxygen Co., Ltd., is paying an interim ordinary dividend of 8 per cent., as in each of the two preceding years.

Major & Co., Ltd., are again paying an ordinary dividend of 6 per cent. for the year ended March 31. Net profit was £25,108 (£19,900).

" Sanitas " Trust, Ltd., for the year ended May 31, record a net profit of £63,031 (£62,059) before taxation, and, with a final dividend of 7½ per cent. are repeating the 12½ per cent. ordinary dividend for the year.

The Beecham Group announces an increased first interim dividend on the deferred share capital. The distribution, which is in respect of the year ending March 31 next, is to be 8½ per cent. (7½ per cent. in 1945-46).

Metal Industries, Ltd., report a net profit of £146,140 (£123,477) for the year ended March 31. A final dividend of 7 per cent. (6 per cent.) on " A " and " B " ordinary stocks makes 10 per cent. (9 per cent.) for the year.

New Companies Registered

Pasta Resin Products Ltd. (417,718).—Private company. Capital £4500 in 4400 £1 shares and 1000 2s. shares. Manufacturers of, and dealers and workers in resins, powders, plastic goods, chemicals, etc. Subscribers: F. C. Kennish, G. Bocking. Solicitors: Slaughter & May, 18 Austin Friars, E.C.

Phenco Ltd. (417,785).—Private company. Capital £1000 in £1 shares. Manufacturers of and dealers in plastic and composition materials and articles, etc. Subscribers: A. T. Pelling; S. G. Strange. Registered office: 1 Queen Victoria Street, London, E.C.4.

Zirconal Ltd. (417,655).—Private company. Capital £1000 in 1s. shares. Manufacturers and dealers in refractory articles and objects; manufacturing, research and analytical chemists, etc. Directors: Major W. E. Smith, C. Shaw. Registered office: 103 Cannon Street, E.C.4.

United Kingdom Essence Company, Ltd. (417,806).—Private company. Capital £1000 in £1 shares. Manufacturers and distillers of and dealers in essential oils, perfume essences, bases and raw materials, etc. Director: E. P. Tuddenham. Registered office: 151 Strand, London, W.C.2.

Hydrocarbon & Resin Developments, Ltd. (417,348).—Private company. Capital £8400 in 8000 6 per cent. cumulative preferred ordinary shares of £1 and 8000 deferred shares of 1s. Chemists, distillers, refiners, dye makers, manufacturers of chemicals and paints, resin, oil, and other fuels, etc. Directors: O. I. Philipp; E. Hene; C. Waite; and H. V. T. Stokoe. Registered office: Princes House, 95 Gresham Street, London, E.C.2.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

LONDON WELDING CO., LTD., London, E. (M., 31/8/46.) July 24, mortgage to District Bank Ltd., securing all moneys due or to become due to the Bank; charged on Reliance Garage, formerly Harrisons Garage, Factory Road, Eastleigh. *Nil. April 11, 1946.

Chemical and Allied Stocks and Shares

WITH less tension in international affairs, stock markets have been firm, small movements ruling in British Funds, while industrial shares were inclined to strengthen, and leading oil shares responded to the big programme of converting railway locomotives from coal-burning to oil-firing. Yield considerations again drew attention to iron and steel shares, the view persisting that the Government will have to slow down its nationalisation programme.

Imperial Chemical were less active, but at 45s. regained part of an earlier decline, as have Dunlop Rubber at 75s. 3d. United Molasses, although active on the possibility of a higher interim dividend, failed to keep best levels, and have eased to 56s. 4½d. Turner & Newall were 89s. 6d., Lever & Unilever 54s. 3d., British Plaster Board 34s. 3d., and Associated Cement 70s. British Aluminium have been firm at 43s. 9d., and British Match 48s. 3d., B. Laporte were again quoted at 100s., while in other directions, Fisons, which remained under the influence of the full results, were active up to the higher level of 61s. British Drug Houses eased to 57s. 6d., and Burt Boulton to 25s. 6d. Shares of the Valor Company showed activity up to close on 70s. Lawes Chemical 10s. ordinary were 13s. 3d., and Greeff-Chemicals Holdings 12s. 6d.

Yield considerations attracted further buying of Thomas & Baldwins 6s. 8d. shares, which rose to 12s. 4½d., Stewarts & Lloyds also moved up to 54s. 1½d., Tube Investments to £6¾, United Steel to 26s. 4½d., Thos. Firth & John Brown to 49s. 4½d., Colvilles to 25s. 9d., and Guest Keen to 41s. Triplex Glass rallied well to 42s. 10½d., and radio shares strengthened, with Cossor 36s., in recognition of the widening scope of the industry's activities. More attention was given to plastics, De La Rue moving up to £12¼, British Industrial Plastics 2s. ordinary were 8s., Erinoid 5s. ordinary 16s. 6d., and British Xylonite £7⅜. Business around 12s. 3d. was shown in British Lead Mills 2s. ordinary, while British Tar Products were 12s. Blythe Colour Works 4s. ordinary have been dealt in up to close on 47s., it being pointed out that there is a good yield assuming last year's dividend total is maintained; according to some views an increased dividend is not unlikely, although it is not, of course, expected that last year's victory bonus will be repeated. Paint shares became rather less firm, with Goodlass Wall 30s. 1½d., Pinchin Johnson 43s. 6d., and International Paint £6¼. Metal Box shares at £5 31/32 lost part of their recent rise, but there was again firmness in textiles, Calico Printers being 43s. 6d. awaiting the results, while Bradford Dyers were 24s. 9d., Bleachers 14s. 6d., Courtaulds 56s. 9d., and British Celanese 36s.

Beechams deferred have risen to 28s. 1½d. on the higher interim dividend, Griffiths Hughes rose further to 64s. and, awaiting the results, which it is being assumed will either confirm or deny deal rumours, Aspro showed activity up to 39s. 1½d. Sangers were 35s., Boots Drug 64s. 3d., and Timothy Whites 48s. 3d. British Oxygen were £5 xd, and Borax Consolidated deferred 48s. 3d. Leading oil shares responded to the better international news and also to the conversion of main line locomotives from coal-burning to oil-firing, Shell being 98s. 9d., Burmah Oil 71s. 10½d., and Anglo-Iranian 100s. 7½d. London & Thames Haven Oil 4s. shares also moved up to 17s., and C. C. Wakefield to 68s. 6d., while Ultramar Oil were better at 75s., and Canadian Eagle Oil 34s. 9d.

Prices of British Chemical Products

THERE have been no special features in the London industrial chemicals market during the past week, quotations throughout displaying a very firm undertone. The demand for shipment has persisted, while the home demand has been fully maintained, and in some directions even increased, with a consequent tightening in the supply position. There has been a steady movement among the soda products, with chlorate of soda in good call. In the potash section, offers of permanganate of potash are finding a ready outlet, and priority users are quickly absorbing the limited supplies of bichromate of potash. A good inquiry is recorded for hydrogen peroxide, formaldehyde, barium chloride, and the lead compounds. Conditions in the coal-tar products market show little change on the week. Pressure for contract deliveries is the chief note, and a firm price position is maintained.

MANCHESTER.—Fairly active trading conditions have been reported on the Manchester chemical market during the past week. Both light and heavy products are being called for in steady quantities against contracts by users in the Lancashire area, including the textile and allied industries, though the movement of supplies is still affected to some extent by holiday conditions. Replacement buying by domestic consumers during the past few days has been on a fair scale, and shippers have been circulating inquiries for a wide range of heavy products on export account. On the whole, moderate buying interest is being displayed in superphosphates and other fertilisers. The tar products market keeps very firm and steady pressure for supplies of the leading light and heavy descriptions is reported.

GLASGOW.—Business in general has been very brisk, and supplies have been inadequate to meet demands. Export business has remained steady.

Price Changes

Rises: Ammonium carbonate; antimony oxide; lead acetate; lead nitrate; litharge; magnesium chloride; oxalic acid; pitch; sodium iodide; sodium sulphate (Glauber salt).

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton, £47 10s.; 80% pure, 1 ton, £49 10s.; commercial glacial, 1 ton, £59; delivered buyers' premises in returnable barrels, £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r. MANCHESTER: £16 to £16 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER: £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—MANCHESTER: £40 per ton d/d.

Ammonium Carbonate.—£42 per ton d/d in 5 cwt. casks. MANCHESTER: Powder, £43 d/d.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £19 10s. per ton. See also Salammoniac.

Ammonium Persulphate.—MANCHESTER: £5 per cwt. d/d.

Antimony Oxide.—£120 to £123 per ton.

Arsenic.—Per ton, 99/100%, £26 10s. for 20-ton lots, £31 for 2 to 10-ton lots; 98/99%, £25 for 20-ton lots, £29 10s. for 2 to 10-ton lots; 96/99% white, £21 15s. for 20-ton lots, £25 15s. for 2 to 10-ton lots.

Barium Carbonate.—Precip., 4-ton lots, £19 per ton d/d; 2-ton lots, £19 5s. per ton. bag packing, ex works.

Barium Chloride.—98/100% prime white crystals, 4-ton lots, £19 10s. per ton, bag packing, ex works.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £18 15s. per ton d/d; 2-ton lots, £19 10s. per ton.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax.—Per ton for ton lots, in free 1-cwt. bags, carriage paid: Commercial, granulated, £30; crystals, £31; powdered, £31 10s.; extra fine powder, £32 10s. B.P., crystals, £39; powdered, £39 10s.; extra fine, £40 10s. Borax glass, per ton in free 1-cwt. waterproof paper-lined bags, for home trade only, carriage paid: lump, £77; powdered, £78.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial,

granulated, £52; crystals, £53; powdered, £54; extra fine powder, £56. B.P., crystals, £61; powder, £62; extra fine, £64.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£22 to £24 per ton, ex wharf. Granulated, supplies scarce.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5⅝d. per lb.

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Carbonate.—MANCHESTER: £8 15s. per cwt. d/d.

Copper Oxide.—Black, powdered, about 1s. 4½d. per lb.

Copper Sulphate.—£33 10s. per ton, f.o.b., less 2%, in 2 cwt. bags.

Cream of Tartar.—100 per cent., per cwt., from £13 17s. 6d. for 10-cwt. lots to £14 1s. per cwt. lots, d/d. Less than 1 cwt., 2s. 5½d. to 2s. 7½d. per lb. d/d.

Formaldehyde.—£27 to £28 10s. per ton in casks, according to quantity, d/d. MANCHESTER: £28.

Formic Acid.—85%, £54 per ton for ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1260 s.g., in tins, £4 to £5 per cwt., according to quantity; in drums, £3 19s. 6d. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—11d. per lb. d/d, carboys extra and returnable.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d per lb., according to quantity.

Lactic Acid.—Pale tech., £60 per ton; dark tech., £53 per ton ex works; barrels returnable.

Lead Acetate.—White, 70s. to 75s. per cwt., according to quantity.

Lead Nitrate.—About £70 per ton d/d in casks. MANCHESTER: £55.

Lead, Red.—Basic prices per ton: Genuine dry red lead, £71; orange lead, £83. Ground in oil: Red, £84; orange, £95. Ready-mixed lead paint: Red, £86; orange, £98.

Lead, White.—Dry English, in 8-cwt. casks, £83 per ton. Ground in oil, English, in 5-cwt. casks, £94 10s. per ton.

Litharge.—£68 10s. to £71 per ton, according to quantity.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £36 per ton.

Magnesium Chloride.—Solid (ex wharf), £27 10s. per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., for 2-cwt lots, 9s. 1d.; smaller quantities dearer.

Mercurous Chloride.—10s. 1d. to 10s. 7d. per lb., according to quantity.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 3s. per gal.; pyridinised 64° O.P 100 gal., 3s. 1d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£100 to £105 per ton in ton lots packed in free 5-cwt. casks. MANCHESTER: £5 per cwt.

Paraffin Wax.—Nominal.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £76 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate. — Crystals and granular, 7½d. per lb.; ground, 8½d. per lb., for not less than 6 cwt.; 1-cwt. lots, ½d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £57 per ton for 5-ton lots, £57 10s. per ton for 1 to 5-ton lots, all ex store; hydrated, £51 per ton for 5-ton lots, £51 10s. for 1 to 5-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 8½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8d. per lb.; technical, £7 14s. 3d. to £8 6s. 3d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Salicylic Acid.—MANCHESTER: 1s. 8d. to 2s. 1d. per lb. d/d.

Soda, Caustic. — Solid 76/77%; spot, £16 7s. 6d. per ton d/d.

Sodium Acetate.—£42 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 6½d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite. — Powder, 60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£36 to £45 per ton, nominal.

Sodium Hyposulphite.—Pea crystals 19s. per cwt. (ton lots); commercial, 1-ton lots, £17 per ton carriage paid. Packing free.

Sodium Iodide.—B.P., for not less than 28 lb., 10s. 2d. per lb.

Sodium Metaphosphate (Calgon).—11d. per lb. d/d.

Sodium Metasilicate.—£16 10s. per ton, d/d U.K. in ton lots.

Sodium Nitrite.—£22 10s. per ton.

Sodium Percarbonate.—12½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £25 per ton d/d for ton lots. Tri-sodium, £27 10s. per ton d/d for ton lots (crystalline).

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salt).—£5 5s. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. MANCHESTER: £4 12s. 6d. to £4 15s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot, £20 2s. 6d. per ton, d/d, in drums; crystals, 30/32%, £13 7s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £20 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £14 5s. to £16 10s., according to fineness.

Sulphuric Acid.—168° Tw., £6 2s. 8d. to £7 2s. 8d. per ton; 140° Tw., arsenic-free, £4 11s. per ton; 140° Tw., arsenious, £4 3s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—Per cwt., for 10 cwt. or more, £15 8s.; 5 to 10 cwt., £15 9s. 6d.; 2 to 5 cwt., £15 11s.; 1 to 2 cwt., £15 13s. Less than 1 cwt., 3s. 1d. to 3s. 3d. per lb. d/d, according to quantity.

Tin Oxide.—1 cwt. lots d/d £25 10s.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d; white seal, £54 5s.; green seal, £53 5s.; red seal, £51 15s.

Zinc Sulphate.—Tech., £25 per ton, carriage paid.

Rubber Chemicals

Antimony Sulphide.—Golden, 1s. 5d. to 2s. 6d. per lb. Crimson, 2s. 2d. to 2s. 6d. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 3s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£37 to £41 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£44 to £49 per ton, according to quantity.

Chromium Oxide.—Green, 2s ped lb.

India-rubber Substitutes.—White, 6 3/16d to 10½d. per lb.; dark, 6 3/16d. to 6 15/16d. per lb.

Lithopone.—30%, £28 2s. 6d. per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Plus 5% War Charge.

Nitrogen Fertilisers

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Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £17 5s. per ton; granulated, over 98%, £16 per ton.

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Benzol.—Per gal. ex works: 90's, 2s. 6d.; pure, 2s. 8½d.; nitration grade, 2s. 10½d.

Carbolic Acid.—Crystals, 11½d. per lb. Crude, 60's, 4s. 3d. MANCHESTER: Crystals, 9½d. to 11½d. per lb., d/d; crude, 4s. 3d., naked, at works.

Creosote.—Home trade, 5¾d. to 8d. per gal., according to quality, f.o.r. maker's works. MANCHESTER, 6½d. to 9¾d. per gal.

Cresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. MANCHESTER: Pale, 99/100%, 4s. 4d. per gal.

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Toluol.—Pure, 3s. 1d. per gal.; 90's, 2s. 4d. per gal. MANCHESTER: Pure, 3s. 1d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 3½d. to 3s. 6d. per gal., according to grade, d/d.

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Wood Naphtha, Miscible.—4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. per gal.

Wood Tar.—£5 per ton.

Intermediates and Dyes (Prices Nominal)

***m*-Cresol 98/100%.**—Nominal.

***o*-Cresol 30/31° C.**—Nominal.

***p*-Cresol 34/35° C.**—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb; 66/68° C., 1s.

***p*-Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

***o*-Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

***p*-Toluidine.**—2s. 2d. per lb., in casks.

***m*-Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON.—August 28.—For the period ending August 31 (October 12 for refined oils), per ton, naked, ex mill, works or refinery, and subject to additional charges according to package: LINSEED OIL, crude, £65. RAPESEED OIL, crude, £91. COTTONSEED OIL, crude, £52 2s. 6d.; washed, £55 5s.; refined edible, £57; refined deodorised. £58. COCONUT OIL, crude, £49; refined deodorised £56; refined hardened deodorised, £60. PALM KERNEL OIL, crude, £48 10s.; refined deodorised, £56; refined hardened deodorised, £60. PALM OIL (per ton c.i.f.), in returnable casks, £42 5s.; in drums on loan, £41 15s.; in bulk £40 15s. GROUNDNUT OIL, crude, £56 10s.; refined deodorised, £58; refined hardened deodorised, £62. WHALE OIL, refined hardened, 42 deg., £89; refined hardened, 46/48 deg., £90. ACID OILS: Groundnut, £40; soya, £38; coconut and palm-kernel, £43 10s. ROSIN: Wood, 32s. to 45s.; gum, 44s. to 54s. per cwt., ex store, according to grade. TURPENTINE, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

4-Chlorophenyl ethers.—J. R. Geigy, A.-G. 23054.

Condensation products.—J. R. Geigy, A.G. 23113.

Light sensitive materials.—Gevaert Photo-Producten N.V. 22906.

Refractory materials.—V. Goldschmidt. 23155.

Acylated esters.—B. F. Goodrich Co. 22952.

Dyestuffs.—N. H. Haddock, W. O. Jones, J. K. Page, D. G. Wilkinson, and I.C.I., Ltd. 22791.

Polymeric materials.—D. A. Harper, and I.C.I., Ltd. 23072-3.

Vulcanised materials.—D. A. Harper, and I.C.I., Ltd. 23074.

Polymeric materials.—D. A. Harper, W. F. Smith, and I.C.I., Ltd. 23070.

Deposition of metals.—Hudson Bay Mining & Smelting Co., Ltd. 22716.

Disinfectants.—R. M. Hughes. (J. R. Geigy, A.-G.). 22716.

Metal flaw detection.—L. Johnson. 22613.

Bituminous compounds.—G. H. King. 22943.

Introducing gases into fluids.—G. W. King. 23086.

Photographic emulsions.—Kodak, Ltd. 22695.

Thieno uracils.—Lederle Laboratories, Inc. 22953.

Albuminous products.—J. Lenderink. 23121-2.

Synthetic resins.—D. McPherson. 23161.

Poly-pentaerythritols.—S. F. Marrian, A. McLean, and I.C.I., Ltd. 23075.

Welding electrodes.—Mond Nickel Co., Ltd. 22715.

Molybdenum articles.—Mullard Radio Valve Co., Ltd., W. A. Anderson, and J. W. Crawford. 22866.

Potassium bitartrate.—Permutit Co., Ltd. 22994.

Glycerine.—Procter & Gamble Co. 22735-6.

Welding of Metals.—R.E.F. Manufacturing Corporation. 22688.

Cleaning of raw wool.—M. A. Renison, and C. Mitchell. 23017.

Ammoniation of superphosphate.—W. Siegel. 23044.

Polymeric materials.—W. F. Smith, and I.C.I., Ltd. 23068.

Composite materials.—W. F. Smith, and I.C.I., Ltd. 23069.

Dyestuffs.—S.A. de Matières Colorantes et Produits Chimiques Francolor. 22738.

Semi-siccative oils.—Soc. l'Impregnation S.A.R.L. 23085.

Smoke-producing compositions.—B. A. Toms, and K. E. V. Spencer. 22809.

Insecticides.—United States Rubber Co. 22792.

Methyl carbinol.—Usines de Melle. 22662.

Polyester-amide compositions.—J. T. Watts, H. G. White, and I.C.I., Ltd. 23066.

Moisture-resistant coatings. — Western Electric Co., Inc. 23001.

Polymeric compositions.—H. G. White, and I.C.I., Ltd. 23067.

Gaseous fuels.—S. H. White. 22739.

Complete Specifications Open to Public Inspection

Polymerisation of ethylene.—E. I. du Pont de Nemours & Co. March 15, 1941. 12116-17, 12120/41.

Manufacture of high molecular compounds. —E. I. du Pont de Nemours & Co. April 10, 1941. 12226/42.

Compositions comprising polymers of acrylonitrile and shaped articles therefrom. —E. I. du Pont de Nemours & Co. June 17, 1942. 9639-40/43.

Synthetic resins.—E. I. du Pont de Nemours & Co. January 31, 1945. 3125-6/46.

Process for the rapid fixation of dyestuffs on cellulose acetate rayon.—Durand & Huguenin, A.-G. February 3, 1945. 8563/45.

Hydrolysis of cellulose materials.—H. M. L. R. Fouque. February 3, 1945. 2253/46.

Preparation of water-repelling agents and process of rendering materials water-repellent.—J. R. Geigy, A.-G. January 31, 1945. 3086/46.

Water-repellent agents, and the treatment of cellulose materials therewith.—J. R. Geigy, A.-G. February 1, 1945. 3094/46.

Poly-n-vinyl pyrrole compounds moulding composition and process.—General Aniline & Film Corporation. February 2, 1945. 1264/46.

Light-sensitive materials. — General Aniline & Film Corporation. February 1, 1945. 4535/46.

Preparation of extracts from aromatic plants, entirely soluble in hot water.—Germinal S.A. January 25, 1945. 27054/45.

Treatment of polymeric methyl methacrylate.—Imperial Chemical Industries, Ltd. January 30, 1945. 2994/46.

Preparation of fatty acid esters.—Lever Bros. & Unilever, Ltd. June 19, 1942. 20367/46

Substituted acridines and intermediates therefor.—E. Lilly & Co. February 3, 1945. 34686/45

Chemical compounds and processes of preparing the same.—Merck & Co., Inc. January 8, 1944. 2779/45.

Manufacture of synthetic rubber.—Phillips Petroleum Co. February 2, 1945. 3116/46

Production of aluminium.—Reynolds Metals Co. January 30, 1945. 24612/45.

Production of crotonic acid.—Shawinigan Chemicals, Ltd. February 2, 1945. 15522/45.

Dyeing of artificial fibres.—S.A. de Matières Colorantes et Produits Chimiques Francolor. January 25, 1945. 17991/45.

Azo dyestuffs.—S.A. de Matières Colorantes et Produits Chimiques Francolor. February 2, 1945. 2141/46.

Water insoluble dyestuffs.—S.A. de Matières Colorantes et Produits Chimiques Francolor. February 2, 1945. 2142/46.

Sulphonic derivatives of guanidine.—Soc. des Usines Chimiques Rhône Poulenc. June 10, 1941. 26490/45.

Electro-deposition of selenium.—Standard Telephones & Cables, Ltd. December 1, 1942. 19830/43.

Deposition of metallic selenium on a base element.—Standard Telephones & Cables, Ltd. December 1, 1942. 1228/44.

Basic alkyl esters.—Sterling Drug, Inc. February 2, 1945. 35232/45.

Complete Specifications Accepted

Production of cyclic amidines or salts thereof.—Boots Pure Drug Co., Ltd., P. Oxley, and W. F. Short. May 26, 1944. 579,303.

Tank or container for fuel or other inflammable liquids.—M. L. Bramson. September 20, 1943. 579,421.

Use of polyester-amide compositions for coating, impregnating, adhesive or like purposes.—J. G. Cook, J. T. Watts and I.C.I., Ltd. December 6, 1943. 579,340.

Manufacture of methyl silicon polymers.—Corning Glass Works. (Cognate applications, 7685/44 and 7686/44.) July 11, 1943. 579,408.

Process for crystallising salts.—F. B. Dehn (Potash Co. of America). June 28, 1943. 579,330.

Vitamin A products and methods of preparation thereof.—Distillation Products, Inc. June 2, 1943. 579,449.

Polymerisation of unsaturated compounds in the presence of thiols and derivatives thereof.—E. I. du Pont de Nemours & Co. March 20, 1943. 579,353.

Polymerisation of acrylic acid derivatives.—L. Fallows, and E. V. Mellers. September 7, 1943. 579,379.

Production of monoesters of ascorbic acid.—Hoffmann la Roche, Inc. May 11, 1942. 579,333.

Production of avation gasoline.—Houdry Process Corporation. January 20, 1942. 579,280.

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1419.   September 7, 1946   Annual Subscription 21s. Overseas 26s.

Iron and Steel Research

ANTIQUARIANS have divided the progress of mankind into "ages" according to the predominant material used for weapons and utensils. The stone age, the iron age and the bronze age have all passed away and it may be that historians of the future will regard this as the steel age. It is certain that steel is one of the great basic materials of our time. The word "steel" is all-embracing. Used originally of what we now term mild steel, it now embraces a vast number of alloys of iron with other elements besides carbon. We have perhaps merged insensibly from the mild steel age to the alloy steel age. Progress in ferrous metallurgy now is less concerned with alloys of carbon and iron than with alloys of many elements, formerly regarded as "rare" with iron or with one another in a matrix of iron. Obviously, the field for experimentation has increased enormously as we have the possibility of adding to iron one or more of the 93 other elements known, any of which may profoundly modify the properties of the metal, either in a satisfactory direction or in the reverse.

The country depends basically upon a supply of steel of good quality and reasonable price. So far as this concerns mild steel and other of the simpler established alloys, it is a matter of business organisation. This country has always been pre-eminent in steel, although in the early years of the present century the American steel industry advanced in a quite remarkable manner to take the first place. This leeway was largely made up in the years before the war when the iron and steel industry was modernised. However, the cessation of building of new works during the war, together with the impossibility of doing more than the most essential running repairs, created a very difficult situation which can only be met now by heroic measures. These measures have been announced by the British Iron and Steel Federation, and although there may be directions in which some will consider they should be modified in the interests of efficiency, it cannot be denied that they are bold, far-reaching and likely to achieve their objective. The appointment of a Steel Board to direct the modernisation programme and to exercise general supervision over the industry sets the seal upon the Federation's plan, and it is extremely unlikely that a policy of nationalisation will find supporters in the future except from those who regard it as a purely political move. The iron and steel industry is quite efficient now

On Other Pages

and will be as efficient as any steel industry in the world when the present plans have been put into effect.

There remains, however, the important matter of advancement in the future. This country must produce better qualities of steel at equal or less cost than anywhere else in the world, and it must be the first to introduce new steels and processes, just as it has generally been the first to discover them. Research must be intensified and this research must be carefully balanced and organised so that it will enable the due proportions of fundamental research, of background research and of applied research to be undertaken together with large-scale development of the results of research.

The formation of the British Iron and Steel Research Association has lately set the seal upon the organisation of the industry in that direction. Recent speeches by the director of the Association, Sir Charles Goodeve, have described the organisation of research in the steel industry. Before the Association was formed there was already a great deal of research. Most of the major steel makers of this country have well-equipped and well-staffed research and design laboratories, and some of these are outstanding. Sir Charles Goodeve has stated that these laboratories will soon be double their pre-1939 size.

The individual research laboratory is the peculiar creation of private enterprise. It is the spearhead of the competitive battle which every firm must wage if it is to maintain its position. There has been a considerable change within recent years in the attitude towards these laboratories. Too often they were started by those who believed that if a chemist were put into a room and left there for a few weeks he would produce new ideas and new products in a continuous stream. Fortunately, this frame of mind is now a long way behind us. It is recognised that the industrial research laboratory must conduct a certain amount of fundamental research, not perhaps pure research in the sense in which research is conceived in universities, but at least what may be termed background research on principles. From this there will grow up a better understanding of industrial processes which ultimately lead to advances in various practical ways translatable into terms of new industrial products.

The co-operative organisation of research in the iron and steel industry may be said to have started during the last war, when committees were set up under the Iron and Steel Institute to investigate certain problems which affected the industry as a whole. Although these committees disbanded at the end of the war, the seed had been sown and the body which is now the British Iron and Steel Federation set up a Fuel Economy Committee and a research group, which, in time, became the Iron and Steel Industrial Research Council. While maintaining their competitive effort in their own laboratories, the great firms which comprised the iron and steel industry continued to collaborate in regard to common technical problems and quite recently set up the British Iron and Steel Industrial Research Association. There are now in the industry three closely-linked yet autonomous bodies: the British Iron and Steel Federation, controlling the business and major administrative side of the industry; the Iron and Steel Institute, which is the technical and professional body of the industry; and now the Research Association.

It is important to notice that the formation of the Research Association is not intended to, and will not, disturb in any way the operations of the laboratories operated by the individual firms. Whether this valuable competitive spur will be lost if the industry is nationalised we do not know; the fact that it may be lost is one of the greatest objections to nationalisation. The problem of collaborating in a research association and yet keeping the competitive spirit alive in private laboratories is one of some difficulty, but it appears to have been solved in the iron and steel industry. Sir Charles Goodeve has divided research into three categories: (a) pure research, (b) background research, these two together forming fundamental research, and (c) applied research. Universities are principally concerned with pure research, to a somewhat less extent with background research, and only to a small extent with applied research. A research association is concerned mainly with background research, to a very much less extent with pure research, and to a moderate extent with applied research, the objective here being obviously to see that background research is carried to the stage when it can be taken up industrially. The industrial laboratory hardly touches pure research. it must do quite a fair amount of background research but its

main effort is devoted to applied research. The function of the Research Association is therefore to see that whatever pure research is needed is done, to undertake the background research, and to leave applied research mainly to the individual firms who will thus apply, each in its own way, the background knowledge discovered by the Research Association. The setting up of a research association should eliminate bottlenecks in respect of background knowledge, but in Sir Charles Goodeve's view, "unless works laboratories are also increased we shall run into a further serious bottleneck at the end when the application of research begins to produce commercial results." The meaning of all this is thus explained by Sir Charles: "The development of steels for high temperature is an important field in which Britain leads the world. She has made her technical advances largely by competitive research in works' laboratories. However, these laboratories are outreaching the background knowledge and have not the time nor facilities to gain it. This background will be obtained first by pooling some of the existing knowledge through the Research Association and then undertaking the missing experiments necessary to complete the picture. With this broadened base of knowledge, competitive research in works' laboratories will carry British high temperature steel to greater heights of technical achievement."

The Iron and Steel Research Association does not propose to set up a central laboratory but to continue the practice of using the existing research facilities in the country, supplementing these where efficiency demands it by special groups of research stations dealing with certain fields. Pure research and certain background research will be farmed out to universities. Individual firms will be asked to undertake operational investigations and development work of new processes of general interest to the industry as a whole. Firms are expected to throw into the pool of the Research Association the results of work carried out on their own initiative, as they have done in the past. Full use will be made of such bodies as the British Refractories Research Association, the British Coking Industry Research Association, B.C.U.R.A., and similar specialist bodies, the principal task here being to ensure that the iron and steel industry's proposals are specifically dealt with in the research work of allied associations and that the results are applied. The picture here presented is highly satisfactory. It is evident that the iron and steel industry has tackled the problem of research in a comprehensive manner which gives every confidence that the industry will be as successful in the future as it has been in the past. We can only hope that the Government will do nothing to disturb by ill-considered proposals for nationalisation the very excellent organisation which is now being built up.

NOTES AND COMMENTS

Nationalisation Opposed

AS the Government proceeds with its plans for nationalising the steel industry, so the leaders of the industry become more outspoken in their criticism of the proposal. The latest contribution in this direction comes from Mr. E. H. Lever, whose opinions, as chairman and joint managing director of Richard Thomas and Baldwins, Ltd., demand a large measure of respect. Speaking at the annual meeting of the company the other day, he voiced the considered opinion of himself and his colleagues on the board when he said the nationalisation of the steel industry *at any time* (the italics are our's) would be against the true interests of the community, since, in their view, it would lead to a decrease in efficiency and to an increase in costs. This is in direct opposition to the Government view, and since Mr. Lever and his colleagues are experts they should be in position to know what they are talking about.

A Serious Blow

DEALING more specifically with the present position, Mr. Lever went a step further in his outspokenness by declaring that to press forward a scheme of nationalisation at this moment, when the industry's plans for development are well advanced, as we point out in our leading article this week, is likely to strike a serious blow at the country's economic recovery, especially as the speedy execution of those plans is essential. At the best, Mr. Lever continued, the uncertainty will

lead to delay, and to an increase in capital cost which the country can ill afford: at the worst, the results may well be disastrous. As an instance of the delaying effect of the Governments proposals, Mr. Lever mentioned the holding up of his own company's plans for the erection of new strip mills in Wales, where, as is well known, unemployment is again making itself felt in a most unpleasant manner. The Government cannot say it has not been warned.

Universities and Science

THERE has been some interesting correspondence in *The Times* lately regarding the attitude of the universities towards the admitted need for increased science teaching in this country. It has been pointed out by Sir Lawrence Bragg that although the Universities of Oxford and Cambridge may not be prepared to expand to the degree required so far as total numbers are concerned, that does not mean to say that their science schools are not growing—indeed, figures have been given to show that they are. Now Lord Cherwell has come along with some comments on another aspect of the problem. While agreeing with the view that a great increase in the number of pure scientists is needed, he claims that the country's greatest need is for a vastly increased supply of thoroughly trained engineers. To teach engineering, it is not enough, in his view, to add just one extra to the many different science departments in an ordinary university; rather, there should be at least four to six professors, each specialising in one of the principal branches of engineering, with a corresponding number of well-equipped departments, as well as numerous courses of lectures and exercises arranged to suit an engineer's needs by professors in the ancillary schools of mathematics, physics, chemistry, etc.

A Better System ?

LORD CHERWELL points out that a full-blown school of engineering on the lines he suggests could not be grafted on to a university in the ordinary sense without throwing the whole place out of balance; to try to make shift with less would, on the other hand, render it almost impossible to give a thorough, generalised training to the engineering pupils. It is for this reason that in the U.S.A. and Germany great independent institutions of university status have been created. There, engineering and all its related subjects are taught by men of the highest standing in departments equipped with all the necessarily elaborate and modern machinery required to instruct the budding engineer. Degrees are given by these institutions just like the older universities. Lord Cherwell will not be alone in his contention that if the universities of this country are given a free hand and adequate funds, they can be trusted not only to maintain the high standard of the humanities, but to continue to develop the pure fundamental sciences which properly belong there as successfully as in the past.

Oil Replacing Coal

LAST week we commented on the wisdom of those industrialists who are considering the use of oil as an alternative source of energy to coal. So far, there has been an encouraging response from industry to the official appeal to turn over to oil consumption, but now doubt is being expressed as to whether sufficient equipment and fuel oil can be obtained at short notice to make effective the desired saving of 20,000 tons of coal before the period when the coal shortage will make itself felt most acutely. The Government expects industry and the railways to use 2,000,000 tons of fuel oil in substitution for 3,000,000 tons of coal in time to avert interruptions in the fuel supply. It would have been easy to ensure the supply of all this additional oil had the decision been taken in the spring, when the tanker programme for the year could have been adjusted accordingly, but now a great effort will be required to get the oil.

TUNG OIL

The Board of Trade announce that as a preliminary step to the restoration of normal trading in tung oil (China wood oil) consumers may in future nominate their own suppliers of this commodity. For the present the Board of Trade will continue to be the sole buyers in the U.K. of this oil from whatever source it may be imported, but licences to acquire from the Board of Trade will be issued by the Directorate of Paint Materials as before and must show the name of the consumer and his nominated supplier. The supplier will then present the licence to the Director of Sundry Materials who will authorise the release of the appropriate quantity of oil. The selling price of tung oil to the consumer is fixed by the Board of Trade at £275 per ton ex-store and includes merchant's commission.

Laminated Plastics

The Utilisation of Resins in their Manufacture

by CHANDRA KANT

THE development of new synthetic resins such as silicones, polyamides (of which nylons are the most famous), polythenes, acrylates (Perspex), glyptals, alkyds, etc., has opened a new chapter in the world's plastic industry.

In India, entirely because of the absence of a flourishing chemical industry, and consequent dearth of basic raw materials, the field of synthetic resins has hardly been touched. The conditions obtaining during the war, especially in the matter of metals, which were in short supply, have led, however, to a highly fruitful field of investigations, *viz.*, the utilisation of natural resins in the manufacture of plastics.

Of the several resins investigated, lac has been found to be versatile in that it has opened up a wide range of industrial applications. Shellac laminated plastics, towards the development of which the laboratories of the Council of Scientific and Industrial Research, the Indian Jute Mills Association, and the Indian Lac Research Institute have made significant contributions, have in particular become useful in the manufacture of various laminated products, containers and drawn laminated mouldings.

Laminated Products

Investigations on shellac fabric laminates were first carried out in 1926, in the University Chemical Laboratories, Lahore. The commercial possibilities of the products attracted wide interest and at least two Indian industrialists, one from Calcutta and the other from Cawnpore, came forward to finance the development work. When the Board of Scientific and Industrial Research was inaugurated in 1940, the problem of resinated fabrics was taken up for investigation once again. Metal containers were in short supply, and there was urgency for finding substitute materials. Resinated laminates of shellac, textile materials, and paper suggested themselves as suitable substitutes, providing scope for the development of a wide range of utility articles and containers.

A considerable amount of basic work both on resin-impregnation of fabrics and paper, and on processing them, has been carried out in the laboratories of the Council of Scientific and Industrial Research. Aqueous alkaline dispersions and solutions of shellac in easily available solvents, *viz.*, methylated spirit, together with hardening agents, have been successfully employed for impregnating jute cloth, cotton cloth, paper, etc., for the production of laminated sheets and boards, including corrugated boards. Sandwiched boards have also been produced in which a filling of cheaper materials, such as impregnated jute waste, is used with outside laminates consisting of more decorative fabric. The products have found extensive fields of application in industry, such as, for example, light building material for the construction of partitions; material for electrical accessories, and switchboards; identity discs; piston ring jigs; tea-chests; silver cans; and other utility ware. The processes of manufacture have been covered by Indian Patents Nos. 28,277 and 28,281 and are being industrially utilised by several industrial groups in the country.

"Jutlac" is the name given to jute fabric-shellac laminates, which have found commercial uses in the manufacture of tea-chests, grease-drums, and containers for dry goods, etc. It has also been used by the British and American Military and Air Force Services. The process of manufacture was first investigated by the laboratories of the Council of Scientific and Industrial research, and was later developed by the Indian Jute Mills Association. It consists of impregnating the laminate surface in a continuous manner between hot rollers with molten shellac.

In another process of resin impregnation developed by the Council of Scientific and Industrial Research and by the Indian Lac Research Institute, use has been made of alcoholic solution of resin obtained by the modification of shellac with urea or melamine. The laminate boards obtained have been claimed to possess remarkable mechanical shock-resistant properties, in addition to low water absorption.

Plastic Containers

Under the duress of wartime shortage of sheet metal of different sizes required in the manufacture of containers, suitable techniques and processes have been developed by the laboratories of the Council of Scientific and Industrial Research for the production of containers from metal substitutes, particularly from shellac fabric laminates. A wide range of plastic containers has been produced, including petrol containers of different capacities up to four gallons, for transport purposes. An outstanding development in this field has been the so-called unburstable containers (Indian Patent No. 28,247) designed for dropping petrol, oil, and other liquid supplies, without the use of parachutes, from low-flying aircraft to troops stranded in inaccessible war zones. Solutions of shellac in alcohol or ammonia have been employed in the manufacture of these containers. For jettison tanks re-

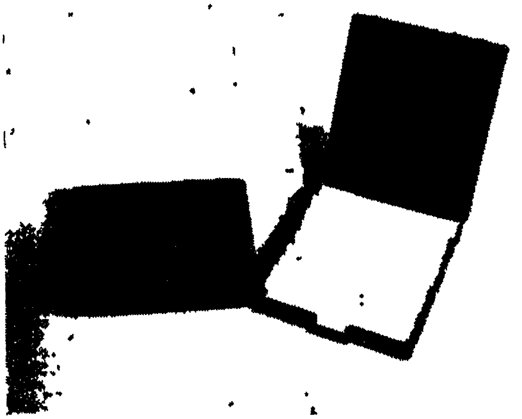


Fig. 1. (left). Cigarette case in multi-coloured checkered cotton cloth-jute core combination in phenolic resin.

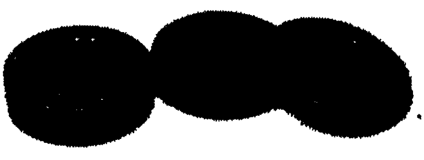


Fig. 2 (right). Shoe polish container moulded in checkered cotton cloth on the outside and jute cloth in the core.

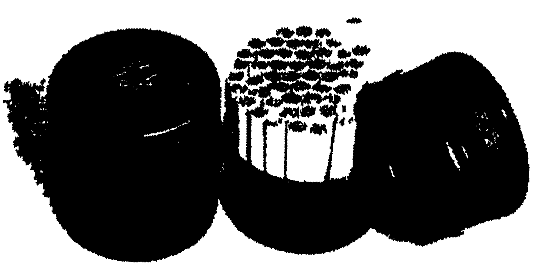
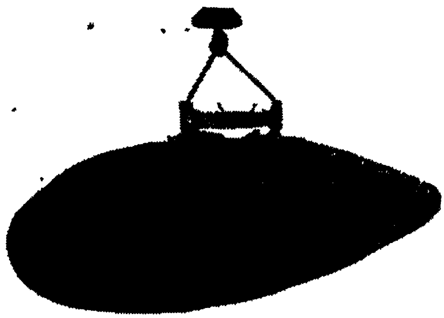


Fig. 3 (left). Cigarette container in two laminations of jute cloth, impregnated with unfilled but dyed thermo-plastic resin.

quired by the U.S A. Air Forces, either dispersions of shellac in water or molten lac with extenders or wetting agents have been preferred.

Early developments in the field of laminated container manufacture entailed the use of heavy hydraulic presses and mould equipment, which became more expensive and unwieldy as the size of the containers increased. Difficulties of procuring this equipment have now led to the development and improvement of simpler processes, better adapted to cottage industry processing, which have found a noteworthy application in the production of 4-gallon petrol containers of satisfactory design. In one of the methods adopted a well plasticised resin solution of 50 50 mixture of de-waxed shellac and de-polymerised shellac, with urea as hardening agent, has been employed to treat the fabric. The solution penetrates into the fabric structure when applied with a paint brush. Several layers of treated fabric which form the main walls of the container are pressed with hand under a hot flat iron, or wooden formers, to make a suitably shaped body of the container, consisting of material resembling hydraulically-

Fig. 4 (right). A 75-gall. jettison tank in single layer of canvas, with inside stiffening walls impregnated and stiffened with plastic composition under 2 lbs./sq. in. pneumatic pressure.



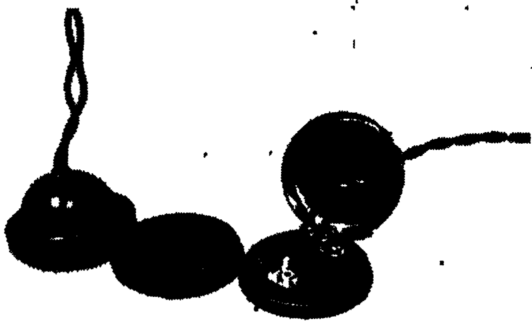


Fig. 5 (left). Electric ceiling rose, in two laminations of jute cloth, impregnated with pigment-filled phenolic resin.

Fig. 6 (right). A 4-gall. petrol tank made of two laminations of impregnated canvas, hand-pressed and stiffened with bamboo strips. There is a screwed metal stopper.

pressed laminated board. End pieces of the container are similarly shaped to form suitable flanges, which can be sealed internally to the main body of the containers. The container body and ends are joined afterwards by resin cement. The mechanical strength of these containers admittedly does not correspond to those made by hydraulic pressure, but it has been found to be sufficient for a great many applications, particularly as 4-gallon petrol containers.

For jettison tanks, another shellac composition containing shellac, casein portland cement, borax, sodium carbonate, and urea has been developed. Envelopes of jettison tanks are machine-sewn in single-ply canvas and transported to the front in rolls, along with the resin composition in a powder form. In the field, the composition is dispersed in water and the solution introduced into the outstretched canvas tanks or bags. The tank is then blown up by means of an ordinary bicycle or tyre inflator to an air pressure of about 2 lb./sq. in. When, under pneumatic pressure, the tank is rolled about, the resin solution spreads and tends to ooze out through the pores of the canvas, thus impregnating the latter thoroughly. The

solution that oozes out is spread on the outside surface of the container and is allowed to set dry. In a few hours an impervious film is formed and the container becomes stiff enough for service. The mechanical strength requirements of these tanks are not rigid as the tanks are used only once. Jettison tanks of large capacities up to 70 gallons have been prepared by this simple and inexpensive process.

Drawn Laminated Mouldings

Investigations on the manufacture of containers from laminates have led to the successful development of drawn laminated mouldings, which has enabled plastic-impregnated laminates to be drawn and moulded in one operation into articles of intricate design. The technique is a combination of metal sheet drawing and pressing, plastic powder compression moulding, and laminated sheet production, and adopts a highly specialised procedure for the design and production of mould equipment. In certain deep drawing operations, a pilot plunger, together with a locking device, for suitably guiding the laminated stock into the moulds, has been found necessary. One associated development involves the production of raised letterings, labels, and trade-mark devices on the moulded articles in different colourings differing from the general background, by the use of dry pigments and colours introduced in the same pressing operation.

The foregoing process has great possibilities as it has very many advantages, including: simplicity of operation, characterised by a single pressing operation as in ordinary plastic powder compression mouldings; the articles produced are much stronger weight for weight and much lighter, strength for strength, as compared with metal products or powder mouldings; possibility of utilising decorative materials such as dyed, printed, and multi-coloured cotton fabrics for exterior laminations and relatively cheaper materials such as jute cloth for interior laminations; and the consequent low cost of production. In the laboratories of the Council of Scientific and Industrial Research, where the process was developed, both simple and intricate shaped articles have been produced, such as containers for shoe polishes, dentifrices, ointments, jellies, cigarettes, etc., ashtrays, electrical mouldings, ceiling roses, etc. Further possibilities of the process, particularly in the production of luxury goods and electrical equipment, are under investigation. One of the most promising fields, however, appears to be the manufacture of automobile body panels, in which lightness, strength, finish and attractive appearance are important considerations; all of these are the special features of this process.

All the foregoing developments in the field of laminated plastics have taken place to meet the exigencies of the war, under acute shortage of metals. Now that the war is over and the general conditions are returning to normal, it might be thought that the processes would lose much of their industrial significance. On the other hand, the importance of these processes will, if anything at all, increase as further investigations on the lines indicated are encouraged, for a new plastics world is born in which laminated plastics will play a great part. Even if India were to have a flourishing chemical industry, as she must in the near future, to supply the basic raw materials for all the latest types of synthetic resins, the utilisation of her vast natural wealth, particularly shellac, will form a fundamentally important aspect of her plastics industry. A fruitful and fascinating field of investigations has been opened up by the Council of Scientific and Industrial Research, and it is to be hoped that future developments will be no less important than those that have already taken place.

Export Credits

Government's Insurance Scheme

THE Export Credits Guarantee Department, which administers the Government scheme of credit insurance, is making an important contribution to the development of Britain's post-war exports, but it is doubtful whether U.K. exporters are sufficiently aware of the facilities now offered by the department for their protection, states the *Board of Trade Journal*

The guarantees available cover most of the risks met with in selling goods overseas, including insolvency, protracted default in payment and the inability of the foreign buyer to obtain sterling when his debt is due. A high percentage of the invoice amount is guaranteed—normally up to 85 per cent. for insolvency or default and up to 90 per cent. for other risks. Exporters holding the department's policies will also find that they are of value should advance and discounting facilities be required from bankers.

This scheme of credit insurance is entirely voluntary and is run on business lines. The department does not, however, seek to make profits, but on the other hand aims merely at being self-supporting and has, in fact, so far not involved the taxpayer in loss. Premiums are kept at moderate levels attractive to exporters, and the number of policy-holders is constantly on the increase.

Chemical exporters who would like further particulars are invited to communicate with the head office of the department at 9 Clements Lane, Lombard Street, London, E.C.4. (Tel.: Mansion House 8771.)

Alkylation Spent Acid*

American Method of Recovery

ALKYLATION spent acid is a waste product from the alkylation process of producing high octane gasoline when using sulphuric acid as the catalyst. This spent acid varies in character with the products treated and with the procedure used by the refineries. On the average, the spent acid contains by weight: acid, 85 to 90 per cent.; water, 2 to 4 per cent, and hydrocarbons 6 to 10 per cent. It is black in colour and fluid at atmospheric temperatures.

Reclaiming of 98 per cent. strength sulphuric acid from this alkylation spent acid is being done by three organisations on the Gulf Coast, one of which is the Consolidated Chemical Industries at its Houston, Tex., plant. Alkylation spent acid, when decomposed at high temperature, will break down into its components, SO_2, H_2O, and O_2. In the Chemical Construction Corporation's process, in use in this plant, the alkylation spent acid is sprayed into a specially designed furnace maintained at high temperature by means of auxiliary gas. The acid is decomposed and the hydrocarbon content supplies part of the fuel required to maintain the high temperature. The hot gases pass through a heat recuperator that serves to pre-heat the air used for combustion while the combustion gases are partially cooled, cleared of acid mist by means of a Cottrell precipitator, and then dried and processed in the contact sulphuric acid plant to full strength 98 to 99 per cent. sulphuric acid. Inasmuch as the acid is completely decomposed into its components and all hydrocarbons burned, the acid from this process is as clean as acid made directly from sulphur and therefore suitable for all purposes.

High Efficiency

This Houston plant was designed for a capacity of 87.5 tons (100 per cent. acid basis) per day, but over a long period has averaged 104 tons of water white acid. One or two men per shift operate the plant. The over-all efficiency of the plant from spent acid to new acid is approximately 93 per cent. The efficiency of the converters from SO_2 to SO_3 is about 96 per cent. In addition, the recovery of H_2SO_4 in the alkylation plant averages 95 to 97 per cent. of the new acid charged.

At the time the plant was visited the spent alkylation acid being processed contained about 85 per cent. H_2SO_4, 12 per cent. carbonaceous matter, and 3 per cent. water. With this type of feed a small amount of fuel gas was required. By blending small quantities of acid sludges of somewhat higher hydrocarbon content, as, for example, naphtha sludges, combustion can be made self supporting and the cost of fuel gas eliminated.

Briefly, the "Chemico" process consists of spraying the spent acid into a furnace where it is decomposed to form sulphur dioxide at a temperature of approximately 2200°F. Hydrocarbons in the sludge, with the addition of gaseous fuel (if needed), furnish the heat required in the process. Gases leaving the furnace pass through a recuperator where heat is recovered by preheating the air entering the furnace. The hot gases are then scrubbed with acid and cooled by direct contact with water. Sulphur dioxide in the water leaving the tower is recovered by stripping with air. Sulphuric acid mist is removed in an electric mist precipitator operating at 80,000 volts. Water vapour is removed by scrubbing with sulphuric acid in a drying tower. The circulating acid is cooled in a suitable cooling system. A centrifugal blower is situated behind the drying tower to propel the gases through the system. The SO_2 gases are then pre-heated and converted to SO_3 by passing through layers of vanadium catalyst. The hot gases leaving the catalyst layers are used to pre-heat the incoming SO_2. The SO_3 leaving the converters is absorbed in strong sulphuric acid where it combines with water to form 98 to 99 per cent. H_2SO_4. The acid is cooled in a suitable cooling system. Acid lost in the alkylation and regeneration cycles can be made up by burning sulphur or hydrogen sulphide in the combustion furnace.

Decomposing Furnace

The Houston plant is advantageously situated near several large petroleum refineries. On arriving at the plant the spent alkylation acid is stored in a covered steel tank. It is pumped directly into the decomposing furnace, consisting of a brick-lined steel shell and sprayer, by using a "spinning cup" burner. This burner produces a thin film of acid by means of centrifugal force. The film is broken into a fine spray by means of compressed air. Fuel gas, when used, is admitted concentrically around the acid burner to provide additional heat required for the process. Three Maxon Pre-mix burners are also installed radially around the furnace. Most of the gas requirements should be introduced in the concentric burner.

It is sometimes advisable to produce more acid than can be recovered from spent acid in order to overcome losses in the alkylation and regeneration cycles. In such a case, molten sulphur from the melting pit is also

*Chem. and Met. Eng., 1946, 53, 102

sprayed into the furnace and burned. This sulphur supplies the necessary additional SO_2, and at the same time provides part of the heat required for decomposition of the spent acid. It is not necessary, however, to burn sulphur unless it is desired to increase the acid production.

Admission of Air

Air is admitted at the front of the furnace, around the acid burner. A silicon carbide tubular heat exchanger of the Fitch recuperator type is used to pre-heat this air to about 1700°F. by means of the heat in the exit gases from the decomposing furnace previously mentioned.

An air fan is provided for use in starting up the furnace, at which time the furnace is under a slight pressure with discharge gases going to the atmosphere through the scrubber tower. Acid must be circulated over this tower. During normal operation the furnace is under a slight vacuum and the fan is used to overcome some of the pressure loss in the recuperator.

The furnace was designed to operate at a temperature of 1900 to 2300°F. with pre-heated air of 1600 to 1700°F., but was operating at 2000° when visited. The oxygen content of the gas leaving the furnace should not fall appreciably below 6 per cent. of oxygen by volume (dry basis). Under these conditions, all of the H_2SO_4 is reduced to SO_2 with a negligible amount of SO_3. Operation at lower temperature would be advantageous since it would reduce fuel costs, furnace maintenance costs, etc., and would allow operation with a higher percentage of SO_2 in the exit gases. However, if the temperature is reduced below 1900 to 2000° F., the decomposition will be incomplete. Hydrogen sulphide, mercaptans, waste SO_2 gases, etc., can be burned in the furnace, if available, and their sulphur content converted into sulphuric acid.

The recuperator is not gas-tight and there is a tendency for some air (20 per cent.) to leak into the SO_2 gas stream. For this reason it is important to balance the pressure on the system properly so as to attain a minimum pressure drop through the recuperator. This is easily kept at a minimum by careful treatment. In a more recent design excessive leakage has been prevented.

Molten sulphur is kept at the temperature for best atomisation (275°F.) and is pumped into the furnace through a sulphur burner, by means of steam-driven centrifugal sulphur pumps. Care is taken to see that there is sufficient air for the amount of sulphur (and other fuels) being burned, as lack of air would tend to cause sublimation of the sulphur.

Gases leaving the recuperator enter a scrubbing tower, a steel shell lined with sheet lead and acid-proof masonry and packed with spiral rings, at about 1120°F. and are cooled by direct contact with re-circulated liquor to approximately 200 to 250°F. Sulphuric acid of 46 to 60° Bé. is used as the re-circulating liquor. This liquor is cooled by means of cooling water flowing through lead coils immersed in lead cooling tanks.

Sulphuric acid mist which might be formed in the process is partially removed in the scrubbing tower. Mist recovered by the mist precipitator is also returned to the weak acid cooling tanks for re-circulation. The concentration of the acid on the scrubber towers can be controlled by applying more or less cooling on the circulation system. The higher the temperature the higher the concentration of the circulating acid.

When the quantity of acid in the cooling tanks increases, it is removed from time to time by adding to the 93 per cent. drying tower as drip acid. If the gases from the decomposing furnace contain too much SO_3, or if the circulating liquor is too weak, or both, there may be an excess of water to take care of which may lead to waste of acid.

Acid is circulated over the tower at all times in order to cool the gases and prevent damage to the lead work, and simultaneously to clean it of any dust or other foreign matter which might be carried over from the furnace or recuperator.

Gases are further cooled to 100°F. in a cooling tower, similar in construction to the scrubbing tower except that this tower is not packed. Fresh water is sprayed directly into this tower to cool and condense water vapour from the gases. This water is fresh, clean, and reasonably free from chlorine, H_2S and salts.

Treatment of Hot Water

Hot water leaving the tower is saturated with SO_2 and contains traces of H_2SO_4. This water goes to a distributing box from which it is pumped over the stripping tower, a lead-lined steel shell packed with spiral rings. Air is drawn through the stripping tower by means of the suction on the system. This air strips the SO_2 from the hot water and returns the SO_2-air mixture to the cooling tower. Water containing a trace of SO_2 discharges from the stripping tower directly to the sewer.

Gases from the cooling tower contain a small amount of sulphuric acid as a fine mist which must be removed before the SO_2 gases can be converted to SO_3. This mist results from the presence of small amounts of SO_3 in the gas stream leaving the combustion chamber. The physical nature of this mist is such that it cannot be removed by scrubbing.

A Cottrell electric mist precipitator is provided to remove this mist before it enters the drying tower. The electrostatic charge on the mist particles causes them to travel

toward the positive electrode and collect on the side walls of the tubes. The resulting weak acid solution runs down the tube walls and out of the precipitator through a sealed boot. It flows by gravity into the scrubbing tower cooler tanks.

Clean gases leaving the precipitator are saturated with water vapour and next pass into a drying tower, a steel shell lined with acid-proof masonry and packed with spiral rings. Here the moisture is removed from the gases by absorption in 93 per cent. sulphuric acid, which is circulated over the tower from a pump tank consisting of an acid-proof masonry-lined steel shell and submerged pump. The acid discharges by gravity from the drying tower and passes through cast-iron cooling coils connected by cast-iron lines to the pump tanks. Water sprayed over the surface of these coolers removes the heat generated by the absorption of the water vapour in the strong acid. Part of the acid circulated over the drying tower is withdrawn continuously and simultaneously replaced by stronger 98 per cent. acid sufficient to maintain the strength of the circulating acid constant at 93 per cent.

Air sufficient to dilute the SO_2 content of the gases to about 8 per cent. is also admitted at the drying tower, and the entire volume of gas passes through a centrifugal blower-exhauster located in the system after the drying tower. This blower maintains the entire purification system previously described under a slight vacuum and delivers the gases under pressure to the primary and secondary heat exchangers.

Important Points

In order to obtain a gas of the highest possible dryness, the following points are of importance:

1. The temperature of acid circulated over the drying tower is kept as low as possible, preferably 75 to 85°F. However, in summer the temperature may go as high as 105°F., all depending upon the cooling water available.
2. The strength of the circulation acid should be kept as uniform as possible; 93 per cent. strength has been found to be desirable for drying purposes. It is also possible to utilise a stronger acid In this case mist formation is likely to occur if the strength is accidentally allowed to exceed 98 per cent.
3. The acid distribution over the tower must be even and a proper amount of acid must be pumped over the tower at all times.

In the heat exchangers the gases are heated to 800°F. before entering the primary converter. In general, the lowest converter entrance temperature possible, but still maintaining the entrance to contact mass above 800°F. will give the highest conversion efficiency.

Two tray converters are arranged in series with a heat exchanger in between for control of temperature. In the primary converter SO_2 oxidises to SO_3 producing heat which raises the temperature of the gas mixture rapidly to about 1100°F. After leaving the contact masses in the first converter, the gases are cooled to 800°F. by passing through the hot side of the secondary heat exchanger where heat is given up to the SO_2-air mixture before it enters the primary converter. This cooling is of importance in order to finish up the reaction and obtain the highest possible yield.

The gases then enter the secondary converter where any residual unoxidised SO_2 is converted to SO_3. This secondary conversion produces additional heat, raising the gas mixture to 860°F. The gases are then passed through the hot side of the primary heat exchanger where heat is transferred to the incoming cold SO_2-air mixture, and are thereby cooled to 475°F. before entering the absorption tower. A small quantity of sulphuric acid is condensed and drained off from time to time.

The asbnrption tower consists of a steel shell lined with acid-proof masonry and packed with spiral rings. The SO_3 in the gas stream is completely absorbed in 98 per cent. sulphuric acid which is circulated over the tower from the strong acid pump tank and 98 per cent. acid cooler. Part of the 98 per cent. acid produced in the absorption tower is delivered continuously to the drying tower to maintain the strength of drying acid at 93 per cent., and the 93 per cent. acid withdrawn from the drying tower is mixed with the absorbing acid, which provides part of the water required for the formation of H_2SO_4 from SO_3. The remainder of this required water is introduced directly into the absorbing acid.

Copper Consumption

U.K. Increase Reported

COPPER consumption in the U.K. rose during July to 42,784 long tons—22,099 tons virgin and 16,685 tons scrap, according to a statement issued by the British Non-Ferrous Metal Federation. This compares with the total for June of 39,580 tons (including 15,890 tons scrap) and a monthly average of 38,286 tons for the first half of the year.

Unalloyed copper products accounted in July for 23,798 tons of metal, of which 14,980 tons went into high conductivity rods and strip, and 5249 tons into strip and sheet. In addition, some 17,758 tons of copper were used for alloyed products, including 6320 tons for extruded rods and sections, 4277 tons for brass strip and sheet, and 4278 tons for castings and miscellaneous products. The balance of 1228 tons of metal was used for copper sulphate.

Digest of Statistics

Chemical and Allied Production and Consumption Figures

DECREASES in the production and consumption of chemicals and fertilisers in the U.K. during June are recorded in the recently-published August issue of the *Digest of Statistics* (H.M.S.O., 2s. 6d. net). It is pointed out, however, that there were fewer working days in June than in May. The figures given represent thousand tons.

Sulphuric acid production, i.e., as 70 per cent. acid and including acid made at Government factories, was 161.3, which is 3.0 less than the May figure, but 1.0 better than the figure for April. The consumption of sulphur for the manufacture of sulphuric acid was 17.0, which is .9 less than the May figure, but the same as that for April. Sulphuric acid consumption is given as 152.0, this being 24.0 less than the figure for May and 6.0 less than the April figure. Stocks of sulphur for the manufacture of sulphuric acid dropped to 58.1, after being 69.3 in May and 59.0 in April, while sulphuric acid stocks are returned at 92.7, which is an increase of 11.3 compared with May and 3.0 better than the April figure.

Less Superphosphate

After reaching the record figure of 95.4 in May, the production of superphosphate dropped in June to 75.1, which is less than it has been since last September. The consumption of superphosphate, which includes deliveries to consumers and the amounts used in compounds, went down to 64.8, as compared with the May figure of 111.9. This also is the lowest figure for several months. There were similary reduced figures in respect of compound fertilisers, production of which is returned at 80.9, as against 116.0 in May and 146.0 in April. The consumption of compound fertilisers dropped sharply to 18.9, a record low figure, comparing with 101.3 in May and the record high figure of 231.1 for April.

Consumption of pyrites in June was 17.6, which is .9 below the May figure and .6 less than that for April. Stocks of pyrites showed an increase, however, the June figure of 88.0 being 4.0 better than the May figure and 6.0 above the April figure. Spent oxide consumption is given as 15.6, compared with 16.5 for May and 16.4 for April. Stocks of spent oxide went up to 139.0, after being 138.5 in May and 134.6 in April.

The consumption of phosphate rock for fertilisers showed a big decline, the June figure of 64.8 being 57.1 below that for May and 52.0 less than the April figure.

Ammonia consumption, including exports and deliveries to consumers in the U.K., but excluding ammonia produced in by-product factories and converted directly into ammonium sulphate, was 25.51, which is 6.45 less than the May figure, but 1.43 better than that for April. Stocks dropped to 3.11, as against 3.?8 in May and 3.26 in April.

July production of iron ore was 211.0, which is 15.0 less than the June figure and 34.0 below the figure for May. There was likewise a drop in pig-iron production, the July figure of 148 being 4.0 below the June figure and 3.0 under that for May. The July production of steel ingots and castings was 228.0 (including 10.0 alloy), which is 22.0 less than the June figure and 34.0 below the figure for May.

Among non-ferrous metals, the production of virgin aluminium was 2.25 in June (the latest month for which figures are given), this comparing with 2.53 in May and 3.29 in April. Consumption dropped to 7.9, after being 9.0 in May and 10.5 in April, this last figure including 2,292 tons lent to France.

Total disposals of virgin copper in June were given as 23.7, which is 6.5 less than the May figure, but only .3 less than the figure for April. Stocks of virgin copper in June were 80.9 (excluding 30.0 held abroad), this being an increase of 7.8 compared with the May figure and .5 better than the figure for April. Virgin zinc disposals totalled 17.1 in June, this being 1.2 less than the May figure, but .8 better than the figure for April. June stocks of virgin zinc were 78.2 (excluding 2.7 held abroad), this being 5.7 under the May figure and 15.9 less than that for April.

Other Metals

Consumption of zinc concentrates in June was 16.9, which is an improvement of 4.7 compared with the May figure and 5.2 better than the figure for April. The June stocks of 125.0 (excluding 22.0 held abroad) were only 1.0 below the May figure and 3.0 under the April figure. Total disposals of refined lead in June were given as 16.4, which is 3.6 less than the May figure and the lowest for eighteen months. Stocks were slightly better at 33.7 (excluding 14.7 held abroad), the May figure being 30.4 although in April it was 37.8. Tin metal total disposals in June were 2.63, after reaching the record high figure of 7.16 in May; the April figure was 6.24. Stocks were 22.4, this being only 1.0 less than the May figure, but 4.8 under the figure for April.

For the first time in seven months, an increase is recorded in the number of people employed in chemical and allied works, the figure (in thousands) for June being 227.8 (including 80.0 females), as compared with 226.9 in May and 225.3 in April.

Metallurgical Section

Published the first Saturday in the month

Metallurgical Section

September 7, 1946

Polarography

The Electrochemical Analysis of Metals

by L. SANDERSON

IN considering the application of polarography to metals, there is no need to dwell unduly on the basic principle of electrolysis, which will be familiar enough to readers of this journal. The point to be borne in mind is that, as Arrhenius's Theory of Electrolytic Dissociation indicates, when a salt is dissolved in water, it breaks up into two distinct components with electrical charges of different sign. These ions obey electrostatic laws whereby the cation or metal ion is attracted to, and deposits at, the cathode and is positive in sign, whereas the ion deposited at the anode is negative in sign. The solid in which these ions originate represents a balance of negative and positive ions, so that it is electrically neutral in itself. The aqueous medium of the electrolytic action has the effect of modifying the interionic field of its high dielectric constant.

When, therefore, anode and cathode in an electrolyte each attract ions of opposing sign, these ions surrender their electric charges, and the cations are deposited at the cathode in the form of neutral atoms. It is the carrying of the electrical charges by the ions that makes up the electric current.

Polarisation of Electrode

In this simple account, however, there is nothing to explain what happens when an electrode is polarised. The fact is that until the potential applied to an electric cell attains a specific and typical value, termed the decomposition potential, virtually no current at all flows. If in the electric field between electrodes immersed in an electrolyte there is a heightening of the applied potential without any corresponding increase of current, both electrode and cell are said to be polarised. However, as soon as the decomposition potential has been attained, there is a sharp increase in current with higher voltages, and eventually a circumscribing value is attained termed the saturation current. This remains unchanged, although, and when the applied potential is increased. Fig. 1 should be examined in this connection. The saturation current is directly proportional to the concentration of ions in process of discharge. What is the explanation? As far as can be seen, there is a potential barrier at the surface of a metallic conductor, and this has to be forced if the ion is to achieve discharge at the electrode.

It was not until the development of modern quantum mechanical theory that these potential barriers began to be understood, but it has been fully demonstrated that they actually exist, and we now know a good deal of the way in which they work. It is clear that it is impossible for an ion to achieve discharge at the electrode until it has been sufficiently charged with kinetic energy to ensure that it will force the potential barrier. Moreover, while in theory it would be feasible for an undischarged ion, not well enough charged with kinetic energy

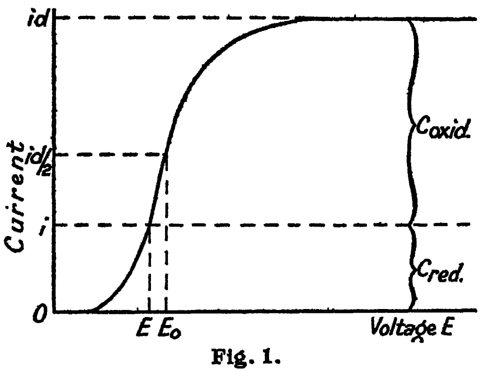


Fig. 1.

to force or leap over the barrier, to burrow through it and so achieve discharge, in actual practice this so rarely happens that there is no need to take it into account.

Any particle in an electric field possesses a kinetic energy directly proportional to the field, and for any specific arrangement of the electrode, proportional to the applied potential. This means that the decomposition potential can be correlated to the height of the potential barrier or to the minimum energy the ions must carry to enable them just to leap over the barrier. The point must be stressed that the total

kinetic energy of the ion has to equal, if not exceed, the height of the potential barrier at the electrode.

We must define this phrase "total kinetic energy" more closely by pointing out that it includes the heat energy of the ion as well as the kinetic energy arising from electrical causes. It is therefore probable that the total number of ions reaching the electrode and achieving discharge, thereby constituting the electric current, will be governed by the electric potential, the temperature, the concentration of ions in the electrolyte, and the number of electric charges carried by each individual ion.

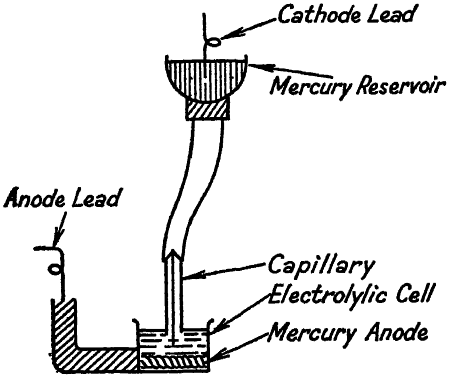


Fig. 2.

This brings us to the expression of a quantity, and it is interesting to note that, departing from a different point, Nernst, as a result of his studies of osmotic pressure, suggested as a means of portraying the reversible electrode process, the equation: $E = E_1 \frac{RT}{nF} \log \frac{C \text{ red.}}{C \text{ oxid.}}$. In this equation, E is the applied electric potential; E_1 is some reference level of potential (*see* later); R is the gas constant, T the absolute temperature, n the valency of the ions or, for preference, the number of electrons taking part in the electrochemical process, F the Faraday constant, C red. the concentration of ions in the reduced condition, C oxid. that of ions in the oxidised condition, facing the electrode.

This equation can be expressed in terms of currents, as follows:

$$E = E_1 - \frac{RT}{nF} \log \frac{i}{id\text{-}i}.$$

Here, id is the saturation current attained after each ion reaching the electrode has achieved discharge; i is the current passing at the applied potential E. Because id depends primarily on the diffusion of ions from the greater part of the electrolyte, it may be referred to as the diffusion current. It will be clear that it is in direct proportion to the concentration of electro-reducible (or electro-oxidisable) substance in the electrolyte. Whether the substance is electro-reducible or electro-oxidisable depends on whether we are taking the cathode or the anode as our starting point.

Because the ions carry the current it is obvious that i is in proportion to the number of ions per second discharged, or to C red., while C oxid. will be proportional to the number of ions queuing up, so to speak, for discharge, or to id —i. Examination of Fig. 1 will show this also. It follows that the two equations given above both apply to every electrolytic oxidation-reduction process whether ions take part in it or not, *i.e.*, as long as a reversibly electro-reducible material is present.

If C red. equals C oxid. in the first equation, the logarithmic term disappears, and E equals E_1. This potential is termed the standard potential of the ion species, and is generally indicated by E_0. From the second equation it follows that for $E = E_0$ it becomes equal to $id/2.E_0$, and for this reason is often termed the half-step potential.

The problem is to work out a system of electrochemical analysis using these Nernst equations as the basis. The first aspect of the problem is that we must employ an arrangement whereby study of the processes at a single electrode only is possible.

The Heyrovsky Electrode

Fig. 2 should now be examined. This shows the dropping mercury electrode developed by Heyrovsky as a solution of this part of the problem. It will be seen that it consists of a container, holding a quantity of mercury, which is connected to a capillary tube through which the mercury falls a drop at a time with a few seconds between each drop, the time interval being constant in each case. The other electrode may be merely a pool of mercury at the bottom of the vessel contacting with a platinum wire sealed through a piece of glass tubing. It will be appreciated that there is here a considerable difference between the surfaces of the two electrodes, which is the type of arrangement complying with what is required.

The energy of an ion is primarily governed by the potential gradient (volt per cm.) and not by the absolute potential applied. In consequence, the very small surface of the drop of mercury, which involves the squeezing up of the lines of force, and the broader surface of the anode, which allows of their opening out, cause virtually the whole of the applied potential to appear across an extremely minute space in the region of the cathode. Moreover, the uninterrupted generation of new and clean electrode surfaces exposed to the electro-

lyte prevents the electrode from being contaminated by electrolytic products. There is also a continual agitation of the solution by the falling of each drop, so that it becomes easier to achieve even diffusion. As each drop grows into the solution and in this way continually encounters new layers of liquid, the results are reproducible and more uniform than they would otherwise be. It must also be remembered that a primary advantage of a mercury electrode is the high value of H_2 over-voltage at a mercury surface.

It is possible to employ a platinised Pt electrode instead of mercury, in which case hydrogen ions will be liberated in advance of a considerable number of metals. Because $H+$ ions are contained in water, satisfactory investigations in aqueous solutions would be impracticable. At every other electrode hydrogen would be discharged at more negative potentials, the difference being the hydrogen over-voltage. Its size is governed mainly by the smoothness of the surface of the electrode, so that, as will be imagined, it attains its maximum at a mercury electrode.

This is the system of electro-chemical analysis originally termed polarography, and the reader should now study Fig. 3 in which the complete equipment is shown. A continually and gradually increasing direct potential is applied to the cell from the potentiometer P. The current corresponding to every voltage co-ordinate is recorded on sensitised paper by the galvanometer G. The paper is wound on a revolving cylinder direct-coupled to the arm of the potentiometer. By this means it becomes possible to trace curves of the form shown in Fig. 1. The potential E_0 are obtained from ½ the saturation current id.

As the standard potentials for almost every practically important type of ion have been measured with precision and tabulated, the ion species being discharged can be obtained. Evaluation of the ion concentration can be had from the id value on the curve (*i.e.*, the step height), because, as previously indicated, id is in direct proportion to the concentration. Polarography provides, therefore, at one and the same time a qualitative and quantitative analysis of electro-reducible or electro-oxidisable materials.

Other Aspects

We have still to consider two other aspects of the subject. In the first place, the solutions must be completely free from air by passing through them H_2 or other agent. Furthermore, the dropping electrode causes the galvanometer to oscillate, and these oscillations increase in size as the instrument becomes more sensitive. It is therefore impracticable to assess the ions if there is a considerable surplus of nobler ones. The reason for the existence of these severe oscillations is the superior concentration of the nobler ions discharged at lower potentials, since these swamp the small steps resulting from the less noble ions. If this ordinary method is adopted, it is feasible to achieve a complete analysis in about 45 minutes.

Research into electrode reactions in alternating fields has, however, led to the development of a novel means of carrying out polarographic analysis. The originators of this method are Breyer and Gutman

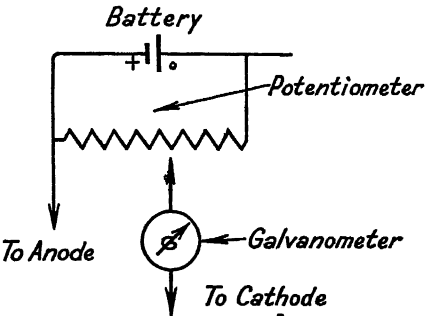


Fig. 3.

of the Department of Organic and Applied Chemistry at the University of Sydney, to whom the author is indebted for the details given in this article. In their method, they use a superposition of direct and alternating voltages, so that the time required for carrying out an analysis is reduced to two minutes, but the prodess is considerably simplified. The principles on which the new method is based are summarised below.

Assuming the cell to be merely a short length of wire, *i.e.*, a so-called ohmic conductor, it would constitute a resistance R to the passage of current i, resulting from the voltage e. $R = e/i$ or $e = i.R$. If this equation is differentiated, it is apparent that for a conductor of this type de/di = Constant = e/i. If such an ohmic resistance is plotted on a current-voltage graph, it forms a straight line.

In the electrolytic cell, achievement of the decomposition potential means that the relation of current to voltage completely ceases to be represented by a straight line, because voltage and current are then in no way connected by an expression of the above type, the cell following the Nernst equation. If, however, direct currents alone are employed, it is possible to represent the cell *at any one point on the curve* by an equivalent resistance $r = e/i$. If, however, an alternating potential is superimposed upon the unvarying voltage, a different treatment is necessary.

Reference should now be made to Fig. 4,

from which it will be seen that restriction to one solitary point of the curve ceases to be feasible, as the instantaneous potential of the cell moves along the curve about the working point E. This point corresponds to the simultaneously applied direct potential, which controls the equilibrium point of the electrode reaction. Note must also be made that the alternating potential is small in relation to point E so as to obviate any marked shift in the equilibrium point.

The resistance of the cell to the alternating current passing through it becomes, for this reason, the dynamic resistance de/di evaluated at the working point E, instead of the static resistance e/i. By differentiation, we obtain the equation:

$$R = de/di = (-RT/nF)\,\frac{id}{i\,(id - i)}.$$

This equation constitutes a function of i, as before, so that it is possible for a value of i to exist that makes the resistance R a minimum. If this equation is itself differentiated and equated to O, as follows:

$$dR/di = (-RT/nF)\,\frac{id(-id + 2i)}{i^2(id - i)^2} = O,$$

it will be seen that the existence of such a minimum is a fact 2i = id or i = id/2. This, in terms of voltages, forecasts resistance minima or current maxima for $E = E_0$. In other words, the a.c. rises from the beginning of discharge, reaches a peak at the standard potential, and goes back to its original value immediately the saturation current region has been attained. By inserting the values in terms of voltage given (2i = id, etc.) in the first equation above before differentiation, the magnitude of the dynamic resistance at Ee is obtained, and it is also demonstrated that the a.c. there is proportional to id and in consequence, to the concentration of the ions being discharged.

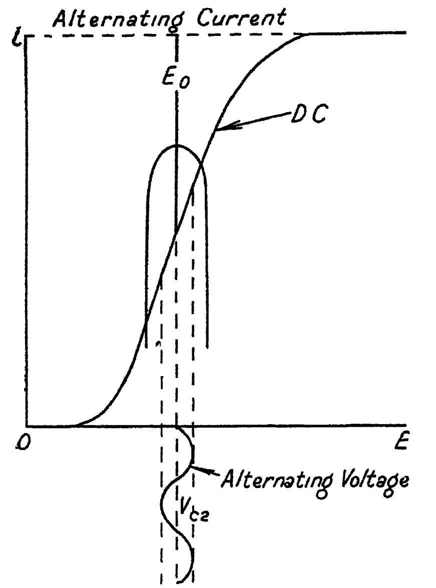


Fig. 4.

The reader must carefully bear in mind, however, that over and above the a.c. that goes through the cell as result of its dynamic resistance, as already explained, further current will go through by reason of the capacity of the electric double layer at the electrode. This is a consequence of the aggregation of ions at the electrode-solution interface, which ions do not possess energy adequate for the overleaping of the potential barrier at the surface of the electrode. Moreover, until the saturation current is attained, there will be an aggregation of ions about the electrode, creating a space-charge. Because these ions are charged particles, they act in the same way as conducting particles, and the space-charge cloud in the region of the electrode will consequently show extra capacity. This capacity fails to become evident with d.c., but in connection with a.c. voltages it is of some consequence.

It is demonstrable that the existence of this alternating field lowers this capacity by a factor of $1/(\omega V - 1)$, where ω is the circular frequency, and V is the amplitude of the alternating voltage applied. The space charge and consequently this dynamic capacity also are in proportion to the concentration of ions, to the surface of the electrode, and to that distance from the electrode in which there reigns a notable charge density. The latter has been found to be in the region of 10^{-4} cm.

The reader may inquire as to the basic difference between the d.c. method and the new a.c. method. It lies in the fact that the d.c. is actually carried by the ions. The a.c. component, on the other hand, constitutes the outcome of the variations in resistance and the capacity of the ion space-charge.

Electrochemical Analysis

By means of this new instrument, it becomes possible to make an electrochemical analysis by rotation of the potentiometer dial until the current, indicated by means of a meter, attains its highest point. This point in turn shows the concentration of the ion species present, and the character of the irons being discharged are obtained as a result of the potentiometer reading. In this way a very rapid and simple quantitative and qualitative analysis is achieved. Often it is possible to analyse in air, or, where essential, after merely a couple of minutes bubbling through of H_2.

World Tungsten Position

Australian Industrialist's Conclusions

SOME conclusions arrived at regarding the world position of tungsten and scheelite, after investigations made abroad earlier this year, were given by Mr. A. R. Bruhn, managing director of King Island Scheelite N.L., on his return to Australia a short while ago.

They appeared in *Industrial Australian and Mining Standard* and are reproduced, in part, below:

1. In both England and America, tungsten consumers insist upon a tungsten ore with very little molybdenum content, as the makers of high-speed tool steels have, since the war ended, gone back to a pre-war specification of a high tungsten content and very little molybdenum content.

2. English tungsten consumers are wolfram-minded, as their plants have, for years past, been used to clean wolfram ore, and they will purchase scheelite up to some 10 per cent. to 15 per cent. only of their total requirements. On the other hand, American consumers are scheelite-minded because their own mines produce scheelite and not wolfram, and, in addition, chemical treatment was developed in America during the war for the purpose of removing molybdenum from scheelite. The resultant product is a very clean high-grade scheelite in better demand than wolfram.

3. Scheelite mines in America produced a big quantity of scheelite during the war, and many of those mines, as a result, have closed down due to running out of ore. The remaining mines have very high costs due to various reasons, and they cannot produce scheelite as cheaply as Australia can to-day. Australian producers have, however, to pay a very high import duty on scheelite into America.

The Largest Consumer

4. America is likely to be a much larger consumer of tungsten than any other country in the world.

5. The American corporation which developed chemical treatment of scheelite to remove molybdenum is, with its associated corporation, one of the two largest tungsten consumers in America. It is now engaged in expanding its chemical works.

6. Tungsten mining in China will not be nearly the same powerful influence on world market price as it was before this war, and tungsten mining in other countries is relatively unimportant from a competitive point of view.

7. Both in England and America, industry generally was very slow in changing from war-time to peace-time production, due to many causes, which are probably by now well known, and it was explained that forecasts as to when peace-time production would be in full swing were so difficult that nobody would entertain entering into fixing contracts for purchase of Australian scheelite.

8. Whereas Australian mining practice is considerably cheaper than mining practice in the American mines, Australian milling practices are, by their standards, both expensive and not in accordance with modern principles. American tungsten mills, for instance, secure a recovery of 93 per cent. of the head value of their ore, whereas our mill cannot do better, with only gravity concentration, than 60 per cent.

Government Metal Notes

Non-Ferrous Scrap

THE Ministry of Supply announce that the stock of non-ferrous scrap on Government charge at June 30 was 199,238 tons, made up as follows:

	Tons
Q.F. Cases and muffled S.A.A. ...	88,209
Ingots	27,810
Lead and lead alloy	1,537
Copper and copper alloy	18,834
Zinc and zinc alloy	11,199
Other grades	51,649

Sales for June-July amounted to 18,889 tons (approximate value of £650,000), divided up as follows:

	Tons
Q.F. and muffled	4,466
Copper and copper alloy	12,204
Lead and lead alloy	1,601
Other grades (including zinc and zinc alloy)	618

U.K. Tin Position

Summarising the tin position, the Ministry notes that stocks in its possession at January 1, 1946, were 23,780 long tons, to which must be added 13,870 tons produced, making 37,650 in all. Of this, 26,661 tons were delivered by way of export, leaving a stock of 10,989 tons at July 1.

Consumers' stocks at the beginning of 1946 were 2186 long tons. Adding deliveries, 13,114 tons, and subtracting consumption, 11,870 tons, the stock at July 1 (calculated) was 3430 tons. Actually 3623 tons were reported held in stock by consumers at that date.

Tin ore (tin content) in stock in the U.K. on January 1 was 7322 tons; on July 1, 7753 tons.

Monazite, an important source of thorium, is not to be exported from Travancore, where it occurs in large quantities, except by arrangement with the British Government. According to the president of the Travancore Legislative Assembly, confidential negotiations are proceeding with this country.

Aluminium Foil

New South African Plant

The new aluminium factory to be erected shortly at Pietermaritzburg by the Aluminium Company of South Africa (Pty.) Ltd., ("OCOSA"), is to produce initially aluminium foil, made largely from ingot produced at the Arvida smelters of the Aluminium Company of Canada, Ltd. Rolling mills for the production are already on order. It is expected that the foil will find a ready market among manufacturers of both sweets and cigarettes.

The plant is also to produce aluminium sheets and circles used for the manufacture of bottle caps, cooking utensils, etc. The company, which took over, as from July 1, control of the Johannesburg office of the Aluminium Union, Ltd., is a subsidiary of Aluminium, Ltd., Montreal. It has a capital of £200,000, which is being put up by the parent company in Canada, and an additional £200,000, required for the construction of the factory and the installation of plant, will, in all probability, also be found in Canada. Equipment will mostly be obtained in the United Kingdom, but the technical processes to be employed and the lay-out will be of Canadian origin.

Steel Production

Notes from France

WHAT is described as a revolution in metallurgical progress is stated to have been worked out by the Société des Forges et Aciéries du Nord et de l'Est, a very fine steel being produced from common steel by adapting the Perrin process to commercial steel.

The method may briefly be described by saying that while the steel is being treated in the ordinary Bessamer-Thomas converter, a charge of special composition is prepared separately in an electric furnace and then poured into a casting pocket. After the converter has run for about 20 to 25 minutes, it is tilted to permit a fine jet of steel to fall from a great height. This produces a close association of the steel and the charge, resulting in a very complete purification of the steel. The advantage claimed for this process is that it provides a high-grade product from ordinary raw materials without the installation of expensive plant.

The French Planning Office has drawn up a preliminary plan for the country's siderurgical industry, aiming at an output of about six million tons of steel in 1947, about equal to the production of 1938, to be increased to 12 million tons by 1950, which would be 20 per cent. above the maximum output reached in 1929. It is estimated that in order to produce economically about 56,000 million francs will have to be spent on modernising plant. The shortage of coke is a serious obstacle to further expansion, although the raw material supply position is good. Iron ore mining is being reduced because of the lack of storage space, stocks amounting at present to 615 million tons, compared with 4 million tons in 1938.

Czech Iron and Steel Output

Slow Recovery

ACCORDING to statistics published in the Czech weekly *Hospodar* (The Economist), output of pig-iron amounted to 424,848 tons in the first half of the current year, as compared with 806,663 in the same period of 1937, the last normal pre-war year. Steel production for the first six months totalled 795,620 tons, or 72.1 per cent. of the pre war output of 1,103,151 tons.

The comparatively large gap in the output figures of pig-iron and steel is explained by the shortage of iron-ore, which is strongly felt. Moreover, the metal content of those ores that are available is too low to make a speedier recovery possible. Another bottleneck is the irregular supply of coke, and as a result only seven out of 13 blast furnaces are at present operating.

The position of the steel industry is somewhat brighter on account of the fairly ample supply of raw material in the form of iron scrap. According to the Government's new Two-Year Plan, pig-iron production is to reach 1.4 million tons by 1948, which would still be about 15 per cent. below the pre-war level, while the target figure for steel is 2.2 million tons, which would mean a small increase over the 1937 output.

The Scientific Society of Zürich, Switzerland, is celebrating its bicentenary this week-end in the Federal Technical Institute. Nearly 300 papers will be presented, including 38 by foreign guests. Two anniversary medals will be issued, bearing the portraits of the great Zürich scientists of the 16th and 17th century, Gessner and Scheuchzer.

LETTER TO THE EDITOR

B.A.C. and T.U.C.

SIR,—The letter written by "Non-Socialist Chemist" in THE CHEMICAL AGE last week confirms my fears that chemists reading your comments will think the B.A.C. has a political bias. The official report, which has been quoted, contained a summary of the proceedings at the general meeting. A summary was necessary as a full report would have been too lengthy, but I would like to quote from the official reporter's typed notes of the proceedings. He reports that I said: "So far as the present discussion was concerned, it had been arranged that Mr. David Jackson would open the debate. Although he had been asked by the Executive to do so, Mr. Jackson would not speak on behalf of the Executive, but would express his own opinions. The Executive asked Mr. Jackson to open the discussion because they wanted someone who knew a good deal about this subject."

Mr. Jackson performed a difficult task in a very able manner and without political bias. He supported affiliation because he believed it would enable certain members to play a more active part in industrial life.

It is unfortunate that the very suggestion of affiliation to the T.U.C. immediately brands an individual or an association as definitely a supporter of the Socialist Party. It cannot be true because there are B.A.C. members who have told me that they consider affiliation would be useful and have also told me that they voted Conservative or Liberal.

The report adopted by Council to which your correspondent refers was prepared by an official who was asked to state the case for and against affiliation, and it was adopted and circulated because it was considered to be a fair statement which was amplified by extracts from speeches made at the meeting.

It is important to notice that the motion proposed by Mr. Jackson only *authorised* the Council to apply for affiliation. It did not *instruct* them to do so. The Council are still free to act as they think fit. The present disputes over "closed shops" may influence a final decision if they are called upon to make one.

I am an active member of the B.A.C. because I am convinced that all professional men should organise themselves into associations which will look after their economic interests. I joined the B.A.C. in 1918 and I have derived very great benefit from membership, in ways which I cannot very well explain here. Such benefits have far outweighed the meagre subscription, and I am anxious that the Association shall become strong enough to carry through to completion plans which will be of the greatest benefit to all our members. We are being hindered by those who say we are becoming supporters of one political party. I hope your readers will not believe that and that some will become members and help us.—Yours faithfully,

NORMAN SHELDON,
Vice-president and vice-chairman of Council of the British Association of Chemists.

London, W.1.
September 2, 1946.

Patents Agreement

An Anglo-French Extension

THE Anglo-French Agreement relating to certain Rights in Respect of Industrial, Literary and Artistic Property affected by the War,* which was to expire on August 29, '946, is to be extended for a period of one year.

Article 1. Priority rights for the deposit of applications for patents, or for the registration of trade marks or industrial designs or models, which had not expired on September 3, 1939, and priority rights which have arisen during the war, or might have risen if the war had not taken place, can still be claimed for applications filed on or before August 29, 1947.

Restoration of pending applications for or of granted rights of industrial property is also possible, conditional to the payment of fees or accomplishing an act as may be prescribed by the laws and regulations of each country. *Bona fide* third-party rights acquired in the meantime are safeguarded, subject to conditions of licence settled by the respective Government departments.

Article 2. Conditions of compulsory licences may be varied and the term of patents may be extended on application of a party who has suffered hardship because of the war.

Article 3. The period between September 3, 1939, and the coming into force of the Agreement (August 29, 1945) was excluded from the prescribed periods for the exploitation of a patent or industrial design or model, and for the use of a trade mark, and no revocation of such an industrial property that was in force on September 3, 1939, should take place solely because of non-exploitation or non-use before August 29, 1947.

Article 4. This relates to the period of renewal of trade marks.

Article 5. The agreement applies to metropolitan France and the U.K. and to such colonies, protectorates and mandated territories as well be simply notified by one contracting party to the other.

* *Treaty Series* No. 5 (1945) of August 29, 1945, Cmd. 6674, H.M. Stationery Office.

Personal Notes

SIR W. GRIFFITHS, chairman and managing director of Mond Nickel Co., has been appointed to the management committee of the Copper Development Association.

MR. NORMAN C. FRASER, A.M.I.Chem.E., and MR. C. N. HILLIER, A.M.I.Chem.E., of W. J. Fraser & Co., Ltd., are leaving for a business visit to India at the end of this month.

SIR ARCHIBALD FLEMING left London airport on Sunday to fly by stages to Rio de Janiero, where he will be the guest of the Brazilian Government at the first Inter-American Medical Congress.

MR. N. ISAACS has joined the board of Derby & Co., Ltd., on relinquishing his appointment as director for ferro-alloys and adviser on wolfram in the Iron and Steel Control of the Ministry of Supply.

Excess Profits Tax Panel

I.C.I. Director as Chairman

A TREASURY announcement issued last week-end stated that Dr. W. H Coates, who is a director and deputy-chairman of Imperial Chemical Industries, Ltd., will be chairman of the Excess Profits Advisory Panel, which will deal with points arising from the use of E.P.T. refunds. In addition to Dr. Coates, there will be five other members of the panel.

The functions of the panel, broadly, are as follows: (1) Approving the arrangements for the use of the refund in cases where it will not be used in the original trade or business by the person who carried on that trade or business or where there has been a change of ownership; and (2) inquiring, after the event, in such cases as they think fit, how the refunds have been dealt with so as to ensure that the statutory undertakings have been observed.

All communications for the panel should be addressed to: The Secretary, Excess Profits Tax Advisory Panel, Treasury Chambers, Great George Street, S.W.1.

It is thought that few cases are likely to be referred to all members of the panel, but each case to a small number only. This method of procedure will enable the panel as a whole to deal with a number of cases simultaneously and result in settlements at a reasonably quick speed.

German Technical Reports

Latest Publications

SOME of the latest technical reports from the Intelligence Committees in Germany are detailed below. Copies are obtainable from H.M. Stationery Office at the prices stated.

CIOS XXIX—12. *The production of tetrahydrofuran intermediates*: Detailed description in German of a "polyurethane" nylon substitute (4s.).

BIOS 534. *The organisation of the German chemical industry and its development for war purposes* (4s.).

BIOS 589. *German light alloy die casting industry—machine tools for die sinking* (1s. 6d.).

BIOS 596. *Gesellschaft Fuer Teerverwertung Larzner-Strasse, Duisburg-Meiderich, Ruhr*: Distillation of tar (1s. 6d.).

BIOS 598. *Oelwerke Julius Schindler G.m.b.H.*: General and specialised lubricants, etc. (1s. 6d.).

BIOS 604. *The shellac industry in Germany* (2s.).

BIOS 639. *Deurag-Nerag. Gewerkschaft Deutsche Erdoel Raffinerie Und Neue Erdoel Raffinerie*: Fuels and lubricants (3s.).

FIAT 297. *Fats, oils and oilseeds* (2s.).

FIAT 362. *Synthetic fatty acids, I.G. Farben. A.G., Ludwigshafen* (6d.).

FIAT 423. *Rhenania-Ossag Mineraloel werke A.G. Harburg Refinery*: Syuthetic lubricating oil manufacture (2s.).

FIAT 429. *Development work for manufacture of caustic soda and sulphuric acid from sodium sulphate* (1s.).

FIAT 645. *The dyeing of spun rayon and rayon filament yarn in mechanical apparatus* (2s.).

FIAT 676. *German scientific literature published during the war* (10s. 6d.).

LEAD DEVELOPMENT

The Lead Industries Development Association has been registered as a company limited by guarantee, without share capital, to continue the activities of the Lead Industries Development Council, which was an unincorporated body. The objects are to promote co-operation between persons, firms and companies, etc., with a view to increasing the consumption of white lead, lead oxides, sheet lead, and lead products. The original number of members is 150, each being liable for £1 in the event of winding up. The council comprises Mr. J. H. Stewart, chairman of Allied Lead Manufacturers; Mr. G. A. Farmiloe, director of T. & W. Farmiloe; Mr. W. E. Grey; Mr. J. L McConnell, managing director of Goodlass Wall & Lead Industries; Mr. W. H. Boyce; Mr. B. T. Millross; and Mr. G. W. Buck. The solicitors are White & Leonard, 4 St. Bride Street, London, E.C.4.

A CHEMIST'S BOOKSHELF

A LABORATORY MANUAL OF QUALITATIVE ORGANIC ANALYSIS. By H. T. Openshaw. London: Cambridge University Press. Pp. 95. 6s.

This book, which was originally compiled for the teaching of University students, has been tested by several years' use, first as duplicated, then as privately printed matter. It can be divided broadly into two sections, the first giving instruction on the procedure to be adopted when subjecting organic substances to analysis, in order to characterise them; and the second giving data necessary for the preparation of derivatives, and tables by which these derivatives may be used to identify approximately six hundred of the more common organic compounds.

The procedure outlined for analysis follows the principles which form the foundation of the well-known Mulliken scheme. The directions are clear, and it is emphasised that in organic analysis no hard and fast scheme suffices, and the analyst must bring into play all his knowledge of the behaviour of the various classes of organic compounds.

The derivatives recommended are orthodox, and an attempt has been made to employ those which do not require great variation in conditions of preparation from member to member of a group. Where necessary, alternative directions are given for preparations, and the tables indicate clearly which is to be preferred for any given compound.

Using this book, the beginner in organic analysis should soon obtain a good grasp of the methods, while the ordinary worker may well find it of use for investigation of the commoner compounds. From it he will naturally turn, in more difficult cases, to the more advanced texts which the author recommends.

Applied Chemical Science

Forthcoming Australian Exhibition

"CHEMEX 1938"—the first chemical exhibition in Melbourne—was acclaimed an outstanding success. It rendered fine service to the public, to educational bodies and to the exhibitors. Now, with the cessation of war, the Australian Chemical Institute (Victorian branch) and the Australian Society of Instrument Technology have agreed, in response to many requests, to co-operate in the organisation of an exhibition relating in the main to recent developments in applied chemical science and the important field of industrial instruments. This exhibition, to be known as "Chemex 1947," will be held from March 5-25, 1947, at the Exhibition Building, Melbourne.

In the near future an official prospectus will be prepared for circulation by the Chemical Exhibition Council. The New South Wales branch of the Australian Chemical Institute is organising a similar exhibition in Sydney in September, 1946, and it is thought that the interval of six months between the Sydney and Melbourne exhibitions will enable many exhibitors to arrange their displays more effectively if they are taking part in both exhibitions.

The floor area of the Exhibition Building is 60,000 sq. ft. and it seems likely on present indications, especially in view of possible participation by overseas manufacturers, that this will not prove at all excessive. The building will be engaged for ample time to permit of erection and subsequent dismantling of stands. The show itself will be open each afternoon and evening, including Saturdays. It is not yet possible to state the rental for stand space, but it is thought that this will be from 2s. 6d. to 3s. 6d. per sq. ft. Exhibitors will erect their own stands to the approval of the Chemical Exhibition Council.

It is particularly desired that as far as possible there should be working exhibits, and every assistance will be given to make this possible. Electricity (230 volts, 50 cycle A.C.), water and gas will be provided. If other services, *e.g.*, compressed air, vacuum, special power supply, etc., are required, exhibitors should state this. Every stand should be in the charge of trained staff, able to explain and demonstrate the exhibits. Direct sales of goods during the exhibition will not be permitted. The intention is that the public should become interested in and be shown goods.

The war just ended emphasised the tremendous importance in modern life of the chemical and allied industries and of scientific instruments for all industries. With her rapid industrial growth during the war period, Australia can now provide a remarkable range of products which should lead to greater home and overseas trade.

The educational possibilities of "Chemex 1947" will not be neglected. To this end the co-operation of Commonwealth and State scientific organisations will be sought and arrangements will be made to display samples of latest goods and equipment developed overseas. Overseas manufacturers are also warmly invited to co-operate in this exhibition.

· **The Indian Copper Corporation** announces that it has ordered a four-high cold rolling mill at an estimated cost of £70,000 for delivery and erection in India. Shipment of plant from the U.K. will begin early next year.

General News—From Week to Week

The Control of Natural Resins (No. 2) Order, 1946 (S.R. and O., 1946, No. 1415), removes damar and gum damar from the provisions of the Control of Natural Resins (No. 1) Order, 1942.

An unofficial strike of about 400 bricklayers started at eight West of Scotland steelworks on Saturday. If it continues, Scottish steelmaking will be crippled and many thousands of workers will become idle.

A very promising response is reported from the West of Scotland to the Ministry of Fuel and Power's campaign to encourage industrial undertakings to convert from coal to oil fuel. An official stated that the Ministry is receiving more inquiries than it can hope to deal with.

Telephone service with Yugoslavia was reopened on September 1, and the minimum charge for a call of three minutes from all places in England and Wales is 20s., and 2s. 6d. extra on calls from all places in Scotland, Northern Ireland, and the Isle of Man.

D.T.D. Specification No. 346, "Soft Aluminium Alloy Sheets and Strips," has been reprinted to incorporate Amendment Lists Nos. 1 and 2; it is obtainable from H.M. Stationery Office (1s.). Amendment List No. 1 to Specification No. 683, "Aluminium Alloy Bars, Extruded Sections and Forgings," is also obtainable (1d.).

Firemen worked ankle-deep in tar, naphthalene, and water last week to suppress a fire at the Manchester works of the Lancashire Tar Distillers, Ltd. Six perpendicular stills in the works yard were ablaze, and the pipe feed broke, flooding the yard and part of the approach road with burning tar. In all, 120 tons of tar was involved.

The "Industrial Ten" supplement of clothing coupons for the 1946/47 ration period will be issued before the end of this year, states the Board of Trade. The opening date will be given wide publicity, and in the meantime employers and workers are asked not to send inquiries to the Board of Trade or to local offices of the Ministry of Labour.

Imperial Chemical Industries, Ltd., announce that of the departments of the southern region sales office which were left at Mill Hill, the engineering trades and metals departments have returned to Gloucester House, 149 Park Lane, W.1. (Tel.: GROsvenor 4020) and the agricultural, dyestuffs, household products and distribution (including packages and accounts) departments are scheduled to return to London on September 13 and 14.

Crude linseed oil has risen in price from £65 to £135 per ton, naked, ex-works, states the Ministry of Food in announcing changes in the prices of unrefined oils and technical animal fats allocated to primary wholesalers and large trade users during the four weeks ending September 28 next. The price has risen, it is stated, because of increased purchase costs.

London Section of the Society of Chemical Industry announces that the first meeting of the new session will be held in the rooms of the Chemical Society, Burlington House, Piccadilly, on October 7, at 6.30 p.m., when Dr. W. H. J. Vernon, D.I.C., F.R.I.C., will deliver the chairman's address, entitled "Chemical Research and Corrosion Control: Some Recent Contributions of a Corrosion Research Group."

The Councils of the Institution of Factory Managers and of the Works Management Association have mutually agreed to form a new body to be known as the Institution of Works and Factory Managers. To this new body the members of the older bodies will be transferred, thus uniting forces and creating an organisation worthy of the personnel of works and factory management throughout the country. All formal matters are well in hand. It is hoped to effect complete transference by November 30.

Trade Expeditions (England) are sending a travelling trade exhibition of British goods to South America at the end of the year. A road convoy of specially designed vehicles will tour Brazil, Argentina, Chile and Uruguay, stopping for periods of up to a week or more in each of the principal towns, depending on its size. This is the first post-war travelling trade exposition of such scope and enterprise, and is being well supported by British manufacturers in many trades. Further particulars are available from Commander A. S. Ward, R.N.R., 1-2, Great Winchester Street, E.C.2.

With the coming into force of the Anglo-Hungarian Payments Agreement on August 27, and with the removal of certain Trading with the Enemy restrictions, commercial relations between Hungary and the U.K., so far as current trade is concerned, can now be resumed, and private traders in the U.K. are free to enter into contracts with private traders in Hungary or with such agencies as may be designated by the Hungarian Government. Inquiries about export possibilities should be addressed to the Hungarian Commercial Representative at 46 Eaton Place, London, S.W.1. (Tel.: SLOane 4048).

The official cost-of-living index figure at August 1 was 105 points above the level of July, 1914, showing no change as compared with a month earlier.

Foreign News

A new "Analytical Chemistry" Division has been added to the Subject Divisions of the Chemical Institute of Canada.

Cost of producing copper at the large Rhodesian mines has almost doubled in the last few years. The annual report of Mufulira Copper Mines, Ltd., states that in 1945 production was 58,275 tons of copper and the cost £38 10s. per ton, compared with 72,459 tons at £21 12s. per ton in 1940.

Manufacture in Tasmania of bronze and brass fabrications has been decided on by Austral Bronze Co. Pty., Ltd., which will extend its manufacturing activities to the island State. The directors are negotiating for the use of a former munitions factory at Derwent Park, near Hobart, and when the company is established, between 200 and 300 hands may be employed.

Menthol production is now a considerable industry in Brazil, 20 factories in the State of S. Paulo being engaged in it. Using Japanese mint as raw material (the original plants are said to have been introduced by Japanese immigrants in 1923), the industry claims a yield of 85 per cent. menthol and two crops a year, instead of the usual single crop and 55 per cent. yield.

The only Canadian plant where RDX was manufactured during the war is being offered for sale by War Assets Corporation, it is announced. Known as St. Maurice Chemicals, Ltd., the plant is located near Shawinigan Falls, Quebec. Built at an approximate cost of $2,500,000, the plant was designed for expansion, and a modern 800-h.p. boiler plant was installed, with pumping station to distribute adequate steam and water.

A modern die-casting plant is to be established at Finsbury, near Adelaide, by Pope Products, Ltd. It will be one of the largest in Australia, according to the company's managing director, Mr. S. Barton Pope. He said capacity at peak production would be between 20,000 and 30,000 castings a day. A wide range of alloys, predominantly of aluminium and zinc bases, would be cast for the trade.

From India comes the information that the Board of Scientific and Industrial Research has tentatively formulated schemes for investigating the possibility of (1) manufacturing dyes from dust, (2) manufacture of graphite, and (3) the manufacture of artificial abrasives. The first two are to be undertaken at the laboratories of the Mysore Iron and Steel Works and experiments in regard to the latter are to be conducted at the Indian Institute of Science, Bangalore.

A contract has been signed for the delivery of 1,000,000 tons of iron ore from Lapland mines to the Bethlehem Steel Corporation's plant in the U.S.A. during the next 12 months. Before the war, Sweden's exports of iron ore to the United States was upwards of 500,000 tons annually.

Forthcoming Events

September 10-11. Institute of Metals (Autumn Meeting). Institution of Civil Engineers, Great George Street, London, S.W.1. September 10, 2.30 p.m.: Official business, followed by three papers. September 11, 10 a.m.: Simultaneous groups of papers (in Lecture Hall and South Reading Room); 1.15 p.m., Annual luncheon at Connaught Rooms, Great Queen Street, W.C.2. Applications to the Secretary not later than September 1.

September 11. British Association of Chemists. Gas Industry House, 1 Grosvenor Place, London, S.W.1, 7 p.m. Mr. J. S. Evans, B.A., B.Sc. (H.M. Inspector of Factories, Engineering and Chemical Branch): "The Factory Acts as They Affect Chemists."

September 11. Institute of Welding (North London Branch). The Fyvie Hall of The Polytechnic, Regent Street, London, W.1, 7.30 p.m. T. J. Palmer: "The Weldability of Malleable Cast Iron."

September 16. Institution of Works and Factory Managers (S.E. London Branch). Bonnington Hotel, London, W.C.2, 6.30 p.m. Mr. A. H. Buckle, M.I.Ec.E.: "Psychological Instability—Government and Working Classes."

September 16-19. Association of Tar Distillers. Programme of meetings at Queen's Hotel, Leeds, 1: September 16, 6 p.m., National Pitch Committee; September 17, 10 a.m., National Creosote Executive Committee, 2.15 p.m., A.T.D. Executive Committee; September 18, 9.30 a.m., A.T.D. Naphthalene Refiners, 10.30 a.m., A.T.D. general meeting, 2.15 p.m. National Creosote Committee, 4 p.m., B.R.T.A. Managing Council; September 19, 9.30 a.m., Pitch Marketing Company and Pitch Supply Association.

September 19. Oil and Colour Chemists' Association (Manchester Section). Visit to works of Monsanto Chemicals, Ltd., Ruabon. Motor coach leaves Lower Moseley Street bus station, Manchester, 9.30 a.m.

September 23-28. Welsh Industries Fair. Drill Hall, Cardiff, 11 a.m.-6 p.m.

September 26-27. Council of Industrial Design and Federation of British Industries. Central Hall, Westminster, London, 10 a.m.

Conference on "Design," in association with the "Britain Can Make It" Exhibition.

October 9. Association of British Chemical Manufacturers. Grosvenor House, Park Lane, London, W.1, 7.30 p.m. Annual dinner.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

KNIGHTS OIL & CHEMICAL CO., LTD., Birmingham. (M., 7/9/46.) August 8, £6000 (not ex.) charge to Lloyds Bank, Ltd.; charged on land, Church Road, Perry Barr. *—. May 15, 1946.

STABLE STEEL WORKS, LTD., Sheffield. (M., 7/9/46.) July 13, £900 mortgage or charge (section 81, 1929 Act), to Mrs. M. C. S. Wood, Sproatley; charged on Favorite Steel Works, Edward Street, Sheffield, and adjoining land. *£900. November 20, 1945.

ANTI-CORROSIVE FINISHES, LTD. (formerly GENERAL ELECTRO-PLATING CO., LTD.), Stockport. (M., 7/9/46.) August 9, mortgage, to Midlands Bank, Ltd., securing all moneys due or to become due to the Bank; charged on 14, 16, 18 and 20 Waterloo Road, and 1 and 3 Canal Street, and warehouse at Joules Court (adjoining last-mentioned premises), all Stockport, together with fixtures. *—. July 18, 1946.

Company News

J. and E. Atkinson, Ltd., is paying an ordinary dividend of 10 per cent. in respect of 1945. This compares with 6 per cent. for 1944.

An increased interim ordinary dividend is being paid by the British Xylonite Co., Ltd., the figure of 5 per cent. comparing with 2½ per cent. (followed by 7½ per cent. final dividend) for each of the last seven years.

Net profit of £14,491 for the year ended June 30 is reported by **United Indigo and Chemical Co., Ltd.** This compared with £10,472 for the previous year. Ordinary dividend is increased from 7½ per cent. to 10 per cent.

Application for leave to deal in the £152,856 ordinary stock of the **Wolverhampton Metal Co.** is being made to the London and Birmingham Stock Exchanges. The capital has recently been increased from £138,960 by the issued of 55,584 ordinary 5s. shares at 17s. 6d., half of which were subscribed by British Metal Corporation.

The Bleachers' Association announces a proposed scheme of capital reorganisation involving a cut of nearly two million pounds in the nominal value of the £3,818,737 ordinary capital. The proposals include the reduction of the nominal value of the ordinary capital by one-half (£1,909,368), this amount being applied in writing down the book values of the fixed assets. This will be achieved by writing down the £1 ordinary stock units by 10s. each.

New Companies Registered

Ada Feld, Ltd. (417,608).—Private company. Capital £1000 in £1 shares. Manufacturers of and dealers in chemicals, gases, etc. Subscribers: R. J. Fabian; R. Moss. Registered office: 62/1, Brook Street, W.1.

C. & G. Chemicals, Ltd. (418,272).—Private company. Capital £100 in £1 shares. Manufacturers of and dealers in chemicals, disinfectants, fertilisers, oils, soaps, etc. Directors: N. S. Campbell; S. Glicher. Registered office: 30, Hassop Road, N.W.2.

P. J. Moran, Ltd. (418,120).—Private company. Capital £1000 in £1 shares. Manufacturers of and dealers in ferrous, non-ferrous, alloy and stainless metals, metal ores, powder metals, metal products, laboratory equipment, etc. Director: P. J. Moran. Registered office: 115 Heywood Road, Prestwich, Manchester.

Chemical and Allied Stocks and Shares

A BRIGHTER tone in stock markets was attributed to more hopefulness regarding international affairs and the renewed strength of British Funds. Industrial shares were firm, with movements mostly small apart from a number of outstanding features, while iron and steels held their recent all-round rally. Oil shares were again rather more active on the big future expansion in oil consumption, necessitated by the coal shortage.

Imperial Chemical have been steady around 44s. 6d., with Dunlop Rubber 74s. 6d., while Turner & Newall strengthened to 89s. 6d. De La Rue advanced strongly on the raising of the dividend from 40 per cent. to 45 per cent. and the expansion in

profits, and at £13 xd held most of the earlier rise. British Xylonite remained at £7¼ following the higher interim dividend, British Industrial Plastics 2s. ordinary were 8s., and Erinoid 16s. 6d. The units of the Distillers Co. showed firmness at 138s., and there was activity around 55s. 3d. in United Molasses, partly on scope for future expansion in the tanker side of the business. British Plaster Board eased to 34s. Associated Cement were 69s. 3d., while in other directions Borax Consolidated at 47s. 9d. regained part of an earlier decline. British Match were easier at 48s., as were Goodlass Wall at 29s. 7½d., although paint shares generally recorded few movements, and Pinchin Johnson improved to 44s. 6d. United Glass Bottle ordinary showed firmness at 93s. 9d. on the big demand reported for glass bottles; in view of the recent increase in the interim dividend the market is expecting a total dividend of at least 15 per cent. for the year. Forster's Glass 10s. ordinary were higher at 46s. 3d., and Canning Town Glass 5s. ordinary 12s. 9d. Triplex Glass 10s. ordinary have been steadier at 42s. 6d., but in other directions General Refractories moved lower at 20s. 9d. Imperial Smelting at 20s. 1½d. rallied, and following beginning of business around 30s. 6d. Wolverhampton Metal 5s. ordinary rose in active dealings up to 33s. 6d. Amalgamated Metal were 20s. 7½d.

Among iron and steels, Guest Keen moved higher to 41s., while Ruston & Hornsby were good at 64s. 3d. and Staveley rose to 52s. 6d. xd on the dividend increase. Tube Investments were favoured at £6 3/16 on current dividend estimates. Stewarts & Lloyds were 53s. 10½d. and Indian Iron advanced 5s. to 92s. 6d. The market approved the terms of Bleachers' capital scheme; the ordinary receded 13s. 9d., but the preference gained 1s. at 27s., a good impression being created by the decision to pay half the dividend arrears in cash. Calico Printers, after easing, rallied to 24s. 6d. on further consideration of the financial results. Courtaulds were 56s. and British Celanese 36s. Metal Industries "B" shares have been good at 62s., and there was better demand for Lever & Unilever, which strengthened to 53s. 6d. Low Temperature Carbonisation 2s. shares, which remained under the influence of the financial results, were firm at 3s. 3d.

B. Laporte were again 100s., Burt Boulton 26s., while Fisons changed hands up to 62s. 6d. and Blythe Colour 4s. ordinary up to 47s. William Blythe 3s. ordinary changed hands at 13s. 4½d. British Lead Mills were dealt in at 12s. British Tar Products were 11s. 9d., while International Bitumen Emulsions shares have been active around 7s.

Boots Drug showed firmness at 64s. 3d. Sangers were higher at 35s. 6d., Griffiths Hughes 64s. and, in anticipation of the results, Aspro shares showed activity up to 41s. 6d. Leading oil shares lost part of recent gains. London & Thames Haven 4s. ordinary transferred up to 18s. 3d. partly on talk of a possible deal in connection with the company's French interests.

British Chemical Prices

Market Reports

STEADY trading activity has been reported in the London chemicals market and a renewed interest in fresh business has been in evidence. The supply position occupies the chief attention of the market, with export inquiries fully maintained. Quotations are firm in almost all directions. Owing to the controlled price of linseed oil having advanced, the prices for lead oxides ground in oil have been increased by £8 per ton, ready-mixed lead oxides by £13 per ton, ground white lead by £7 10s. per ton and ready-mixed white lead paint by £12 per ton. There is no change in the prices for dry lead oxides and dry white lead. There has been nothing of outstanding importance to record in the general run of industrial chemicals, and in the coal tar products market supply conditions are unaltered, with pitch quoted higher for shipment.

MANCHESTER.—Traders on the Manchester chemical market during the past week have reported a fair flow of new inquiries. These have included additional offers of business for export covering the alkalis and other heavy chemicals. Replacement buying on home trade account is on steady lines and there has been less interruption through holidays of deliveries to industrial users under contracts. Caustic and other soda compounds, as well as the magnesia and ammonia products and the mineral acids, are being taken up in good quantities. A moderate trade is reported in some of the fertiliser materials, while steady trading conditions continue in respect of the leading tar products, both light and heavy.

GLASGOW.—There has been a considerable advance in prices in the Scottish heavy chemical market, principally due to increased railway costs, and, in general, there is a large volume of business. Export business and inquiries are very numerous.

Price Changes

Lead, Red.—Ground in oil: red, £92 per ton; orange, £104. Ready-mixed lead paint: red, £99; orange, £111.

Lead, White.—Ground in oil: English, £102 per ton.

Linseed oil, crude.—£135 per ton, naked, ex works.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Centrifugal pumps.—A. Abbey. (Jönkopings Mekaniska Verkstads Aktiebolag.) 23582.

Heat-resisting alloys.—Allegheny Ludlum Steel Corporation. 23403.

Ammonium fluoride.—Aluminum Co. of America. 23516, 23517.

Fluoboric acid—Aluminum Co. of America. 23515.

Sulphurised oils, etc.—Anchor Chemical Co., Ltd., and K. C. Roberts. 23811.

Hydrocarbon oil blends.—C. Arnold. (Standard Oil Development Co.) 23323.

Heat generation.—C. Arnold. (Standard Oil Development Co.) 23325.

Hydrocarbons.—C. Arnold. (Standard Oil Development Co. 23898.

Hydrocarbons.—J. C. Arnold. (Standard Oil Development Co.) 23324, 23326, 23901.

Gaseous, etc., fuel production.—J. C. Arnold. (Standard Oil Development Co.) 23327.

Centrifugal pumps.—J. F. Belaieff, C. T. Delaney, and Gallay, Ltd. 23545.

Hard metal alloys.—British Thomson-Houston Co., Ltd. 23301.

High density alloys.—Callite Tungsten Corporation.—23701.

Acid ethers.—G. P. Crowley, A. Macarthur, S. H. Oakeshott, E. G. Parry, and I.C.I., Ltd. 23400.

Polymers.—J. Downing. 23855.

Chemical process.—E.I. Du Pont de Nemours & Co. 23396.

Benzenes.—E.I. Du Pont de Nemours & Co. 23668.

Thermoplastic tubing.—Extruded Plastics, Inc. 23406.

Recovery of water soluble substances.—A. Heilmann. 23903.

Synthetic resins.—E. Heue. 23353.

Dispersion of carbon black.—J. M. Huber, Inc. 23510.

Furnaces.—International Alloys, Ltd., and F. G. Bacon. 23291.

Colouring matter.—W. O. Jones, and I.C.I., Ltd. 23399.

Thiophanes.—Ledeste Laboratories, Inc. 23513.

Fertilisers.—C. W. Levy. 23756.

Metallurgical processes.—R. M. McNutt. 23886.

Deep drawing metals.—Massilon Aluminum Co. 23658.

Organic compounds.—N.V. de Bataafsche Petroleum Maatschappij. 23463.

Synthetic resins.—G. Natta, and E. Beate. 23404, 23405.

Chemical, etc., process.—J. E. Nyrop. 23657.

Biological processes.—J. E. Nyrop. 23817.

Measurement of electrochemical potentials.—F. G. Paully. 23558.

Therapeutic compositions.—M. A. Phillips. 23387.

Chemical compounds.—M. A. Phillips. 23509.

Plastifiers.—Soc. Francaise de Raúnage. (France, June 11, 45.) 23713.

Bleaching materials. Soc. Rhodiaceta. 23424.

Surface treatment of aluminium, etc.—Sperry Gyroscope Co., Inc. 23865.

Vitamin preparations.—J. S. Spolecnost. 23679-81

Separating alloys.—Spolok Pro Chemickou a Hutní Výrobu. 23210.

Hydrocarbon polymers.—Standard Oil Development Co., and C. Arnold. 2332.

Hydrated lime.—F. P. Stowell. 23397.

Atomisers.—E. Strauss 23753.

Phenol base powders.—G. Truffaut, and I. Pastac. 23625.

Arc welding electrodes.—Welding Supplies, Ltd (Elektriska Svetsningsaktiebolaget. 23269.

Iodine compounds.—G. N. White. 23816.

Complete Specifications Open to Public Inspection

Refining of crude acrylonitrile.—American Cyanamid Co. Dec. 1, 1942. 21823/43.

Beneficiation of cobalt-nickel ores—American Cyanamid Co. Feb. 6, 1945. 3238/46.

Heat-hardenable phenolic resins.—Bakelite, Ltd. Feb. 7, 1945. 3726/46.

Electro-thermo-chemical processes such as combustion, distillation, synthetic tractions, molecular or atomic dissociations and the like, particularly applicable to organic bodies. Feb. 12, 1945. (Cognate applications 20269/70/46.) 20268/46.

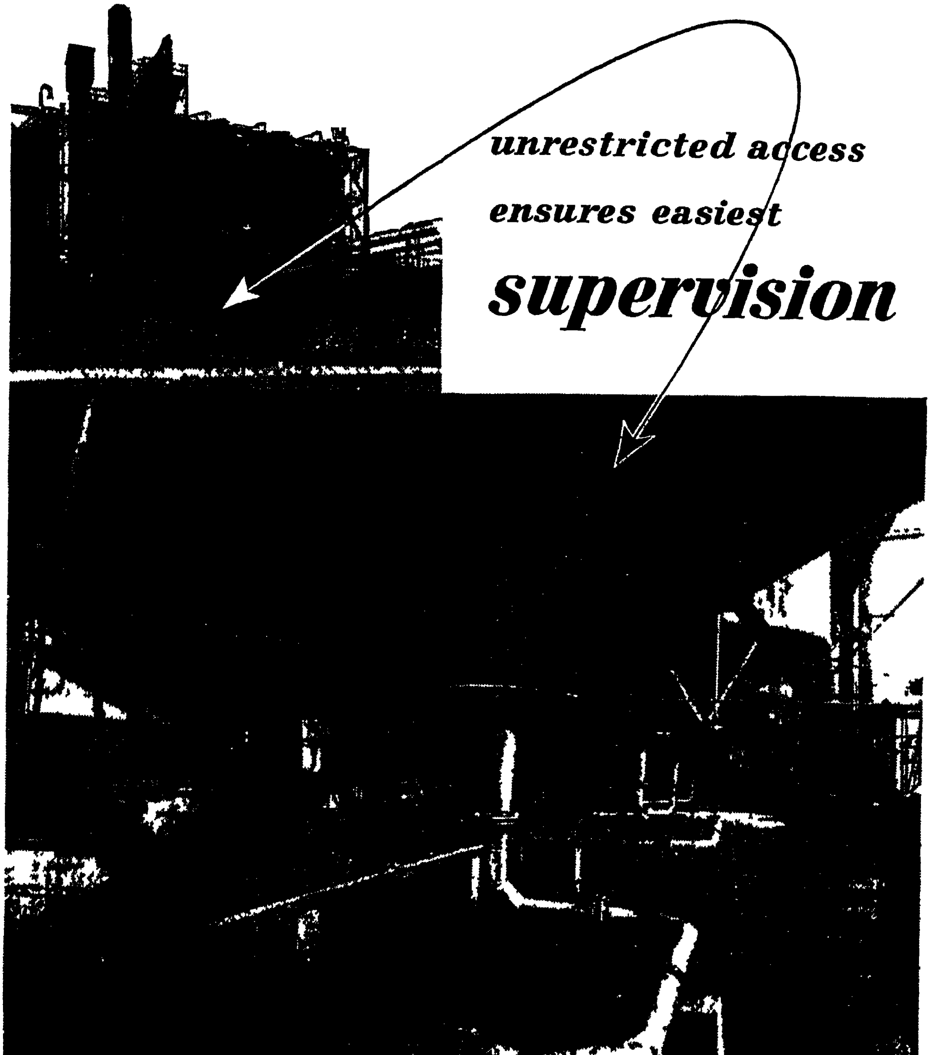
Alkylsilicon sols and gels.—British Thomson-Houston Co., Ltd. Feb. 10, 1945 3438/46.

Organosilicon-silica sols and gels.—British Thomson-Houston Co., Ltd. Feb. 10, 1945 3439/46.

Producing vinyl fluoride polymers.—British Thomson-Houston Co., Ltd. Feb. 13, 1945. 3746/46.

Treatment of ground wood pulp.—Buffalo Electro-Chemical Co., Inc. Feb. 5, 1945. 31479/45.

Esters and process for making same.—Carbide & Carbon Chemicals Corporation. Feb. 6, 1945. 1307/46.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Treatment of the surfaces of articles made of aluminium or its alloys.—Compagnie de Produits Chimiques et Electrometallurgiques Alais, Froges & Camargue. Feb. 10, 1945. 1039-40/46.

Halogenation of hydrocarbons.—Compagnie Française de Raffinage. Nov. 23, 1943. 20668/46.

Alcoylating aromatic hydrocarbons.—Compagnie Française de Raffinage. Dec. 18, 1943. 20669/46.

Production of solutions comprising polymers of acrylonitrile.—E.I. Du Pont de Nemours & Co. June 23, 1943. (Cognate application 11948/44.) 11947/44.

Polymerisation process and products thereof.—E.I. Du Pont de Nemours & Co. Feb. 9, 1945. 4172/46.

Polymerisation of monoethylenic compounds.—E.I. Du Pont de Hemours & Co. Feb. 9, 1945. 4173/46.

Production of partially hydrolysed vinyl ester polymers and interpolymers.—E.I. Du Pont de Nemours & Co. Feb. 13, 1945. 4489/46.

Azine dyestuff images.—General Aniline & Film Corporation. Feb. 9, 1945. 4536/46.

Diacylamidobiphenylenedioxydialkyl carboxylic acids and process of preparation.—General Aniline & Film Corporation. Feb. 7, 1945. 5872/46.

Hydrogen production.—Hercules Powder Co. Feb. 6, 1945. 2004/46.

Herbicidal compositions.—I.C.I., Ltd. Feb. 9, 1945. 4179/46.

Moulds for making lenses and like optical elements from polymerisable synthetic plastic materials, resins and the like.—International Polaroid Corporation. Oct. 16, 1942. 16910/42.

Light polarisers and manufacture of same. —International Polaroid Corporation. Feb. 8, 1945. 1005/46.

Solutions containing a high percentage of organically combined calcium.—Koninklijke Industrieele Maatschappij Voorheen Noury & Van Der Lande N.V. Feb. 13, 1945. 8388/46.

Effecting the precipitation and/or crystallisation of solids in solution, particularly in the softening of water.—L'Auxiliaire des Chemins de Fer et de L'industrie. Feb. 9, 1945. 20380/45.

Producing salts of antimalarial organic bases, and the products resulting therefrom. —E. Lilley & Co. Feb. 7, 1945. 12467/45.

Production of solutions and dispersions of surface active cleansing and dispersing agents. — J. Malecki. April 14, 1944. 20989/46.

Chemical compounds and process for preparing the same.—Merck & Co., Inc. Feb. 9, 1945. 2830/46.

Manufacture of objects by applying a molten metal mass to a metal surface.—N.V. Philips Gloeilampenfabrieken. Feb. 8, 1945. 3581/46.

Hardening of alloys.—N.V. Philips Gloeilampenfabrieken. Feb. 8, 1945. 3583/46.

Organic sulphides.—Park, Davis & Co. Feb. 9, 1945. 2302/46.

Production of para-oxy-phenyl-arsenic acid.—J. A. Pascual. Feb. 7, 1945. 3755/46.

Process for obtaining 4-4'-dioxi-3-3'-diamino - arseno-benzene-sodium-methane-sulphoxylate.—J. A. Pascual. Feb. 7, 1945. 3756/46.

Electron discharge tubes.—Raytheon Manufacturing Co. Feb. 10, 1945. 2161/46.

Preparation of acid anthraquinone dyestuffs.—Sandoz, Ltd. Feb. 12, 1945. 3624/46.

Manufacture of fibres from thermoplastic materials such as glass.—Soc. Anon. des Manufactures des Glaces et Produits Chimiques de St. Gobain, Chauny & Cirey. Feb. 12, 1945. 4327/46.

Regulation of extruding presses.—Sulzer Freres Soc. Anon. Feb. 10, 1945. 994/46.

Production of aldehydes and ketones.—Usines de Mello. Feb. 8, 1945. (Cognate application 1351/46.) 1350/46.

Plating surfaces with tungsten, chromium or molybdenum.—Western Electric Co., Inc. Sept. 30, 1943. 18412/44.

Complete Specifications Accepted

Manufacture of bituminous materials.—Limmer & Trinidad Lake Asphalt Co., Ltd., D. C. Broome, J. Lewis, and S. C. Lewis. August 17, 1942. 579,368.

Treatment of polyvinylidene chloride.—D. McCreath, L. Wood and I.C.I., Ltd. May 13, 1944. 579,448.

Explosive primers.—G. Morris, and I.C.I., Ltd. June 16, 1943. 579,281.

Pressure responsive devices comprising diaphragms and the like.—H. N. Negretti, P. E. Negretti, and E. F. Greening. January 27, 1944. 579,289.

Production of hydrocarbons.—D. H. P. Peel, and I.C.I., Ltd. October 28, 1940. 579,363-4.

Manufacture of condensation products, having capillary activity.—Soc. of Chemical Industry in Basle. March 6, 1942. 579,370.

Lubricating oil compositions.—Standard Oil Development Co. December 31, 1941. 579,418.

Demolition blasting charges for military and other purposes.—J. Taylor, and I.C.I., Ltd May 3, 1943. 579,279.

Production of plastic detonating explosive compositions.—J. Taylor, D. S. Fensom, and I.C.I., Ltd. August 10, 1943. 579,376.

Process for the purification of 4-hydroxycoumarins.—Wisconsin Alumni Research Foundation. August 29, 1942. (Divided out of 578,589.) 579,459.

Explosive compositions comprising low freezing liquid mixtures of aromatic nitrocompounds.—H. R. Wright, J. Taylor, and I.C.I., Ltd December 18, 1942. 579,275.

Manufacture of high explosive compositions or charges.—H. R. Wright, J. Taylor, and I.C.I., Ltd. August 18, 1942. 579,283

Non-detonating fuse compositions and fuses made therewith.—H. Zenftman, and I.C.I., Ltd. October 6, 1943. 579,388.

Sulphonyl guanidines and methods of preparing same.—American Cyanamid Co. April 11, 1942. 579,513.

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1420. September 14, 1946 Annual Subscription 21s. Overseas 26s.

The Scientist as Administrator

IT is a curious fact that many people believe themselves to be born administrators. We recollect showing a group of public schoolboys round a chemical works not so long ago, accompanied by their careers master. The purpose was to encourage them to enter the profession of chemical engineer. Consequently, it was arranged that at some time during the day every boy should have a few minutes' chat with a senior member of the staff, and in the course of that chat every boy was asked what he wanted to be. At least 80 per cent. replied that they wanted to be an "administrator." Pressed to explain how they proposed to reach that exalted position, the boys, almost without exception, replied that on leaving school they expected firms to offer them such jobs right away, and clearly believed, moreover, that they would thereupon be given a large desk in a well-furnished room, there to sit like a spider in the centre of things "directing" the activities of grown men and women who would be told exactly what to do by the "administrator." It did not seem to have dawned on anyone that the administrator needs wide experience of men and affairs to do his job successfully, nor did anyone appear to have the least conception of what an administrator was supposed to do. Possibly that may be the effect of translating boys into prefects; but it suggests a lack of realism on the part of the careers master, who should surely be charged with the job of explaining industrial conditions to his boys.

Is this example unique? Do the delusions of youth die with adolescence? We doubt it. Witness the frequent demand that the scientist should take a prominent place in government, solely on the ground that he knows scientific facts and will therefore not make obvious mistakes that a little scientific training would avoid. This demand comes from scientists, and seems to be unpopular among politicians. We have no evidence that the unscientific politician is necessarily a good administrator. We are, in fact, witnessing at the moment the working out of the universal truth that the amateur does not make a good professional without further experience. For any work, training and experience are essential, and, with the complexity of modern life, are becoming more essential than ever before. The wisest administrators recognise how little they know. Cardinal Richelieu, on being asked by his niece, an abbess, for support in a legal action, refused on the ground that it would lead to his authority being discussed:

On Other Pages

"Whether you rule an abbey, a village, a realm, or a nation," he said, "you must always be careful not to allow anyone to discuss your intentions. Act, and let your actions alone be discussed." Is not that the antithesis of the scientific method, which demands discussion of the probable mechanism of reactions so that all is laid bare from start to finish? Much the same thought was expressed later by Lord Mansfield: "Give your decisions, never your reasons; your decisions may be right, your reasons are sure to be wrong."

We shall risk the execration of every youthful scientist by proposing the thesis that only indifferent scientists should attempt to become administrators. Administration is a human problem; the good scientist is not necessarily sufficiently humanised to be an administrator, a ruler of men and women. He may assess the technical problem correctly, but only a few scientists will be equally at home with the intangible human reactions to what is done. We have heard it said that the most ghastly fate that could overtake human society would be for it to be run like a machine or a chemical reaction, ordered and governed by scientific principles only. Hsiung, the Chinese philosopher and writer, tells of a prominent scholar who once remarked to him that the Chinese language was the second most difficult thing to tackle in the whole world; the first, he added with a sigh, being his wife. Therein lies the crux of administration. Technical problems are the second most difficult thing in the world: the first being human relationships. Scientists as a class have the reputation of glueing their eyes to the test-tube, whereas the administrator must lift his up to the hills. We question whether scientists in general make good administrators; there are, of course, exceptions, but is not their function primarily to advise the trained administrator—whether he be politician, town councillor, or managing director—on scientific matters of fact, leaving to others the task of making decisions which must often be made by intuition or by a deep knowledge of the human mind?

The problem goes farther than that. We have lately read an article by Sir George Stapledon, F.R.S., in *The Countryman*. "I am sure," he wrote, "the incubation of ideas is greatly favoured by long periods during which a man will work alone and do everything for himself. A scientist will begin to deteriorate as a scientist, and perhaps also as a man, when he ceases to work with his own hands, when he ceases to coordinate hand and brain. He may still be a useful citizen, perhaps a good administrator, and fulfil necessary functions, but he will have lost something in insight and power. . . . The danger is very real at the present time when, because of the shortage of well-trained men, first-class scientists are likely to attain to positions of administrative responsibility and leadership while still quite young. These men, the custodians of future research, should be supremely on their guard."

Why should scientists wish to become administrators? What is the glamour, whence is the glamour, that surrounds the administrator? Is it anything more than the assumption of greater authority, or the receipt of a higher salary? If it is these things, then again we declare that the really good scientist should not be lost to scientific work by being made an administrator. The time is surely coming when younger men will be selected, either at their university or within a very few years of entering industry, to be trained as administrators. If, as we maintain, administration is in fact the hardest job in the world, why should we not train men for it? Why should we promote to the administrator's chair men who happen to have shown ability in quite other walks of life?

In support of our thesis we might cite the case of an eminent scientist who was persuaded—against his better judgment, we believe—to accept a politically administrative post. Having a first-class brain, he fulfilled his duties with great skill and with lasting and beneficial effect to the community. But he conceived a violent dislike for the attendant conditions, and gladly threw off the chains of office at the first opportunity, convinced that science and politics do not mix.

No! Again at the risk of being hanged, drawn, and unpleasantly quartered, we maintain that *as a body* scientists who are good at their scientific work should remain at it. The lure that attracts them away from it, whatever it may be, should be removed. That may imply higher pay for scientific and technical men; it may mean a higher status in the organisation in which they operate; it may involve setting up technical departments which are more nearly autonomous than they are to-day. But whatever it is let us keep the true scientists away from administration in order that they may make their best contribution to the problems of the day.

NOTES AND COMMENTS

Cost of Atomic Energy

SOME figures collected by the Washington correspondent of the *Financial Times* and published last Tuesday bear out the findings of Mr. Dutton in our principal contributed article this week. The figures have been extracted from the report submitted by a group of scientific advisers to Mr. Baruch, U.S. representative on the United Nations Atomic Energy Committee. Due notice having been taken of both the dangers and the advantages of an atomic energy plant, the report comes to the conclusion that it would be possible to produce electrical energy at an operating cost some 26 per cent. higher than with a plant using coal. Basing their estimates on current costs in the United States, Mr. Baruch's advisers give their opinion that a complete nuclear power plant producing 75,000 kW could be built "in a normal locality in the Eastern United States" for about $25 million (£6,250,000). Assuming operation at 100 per cent. capacity, and interest charges at 3 per cent., operating costs would be about 0.8 cents per kWh. A comparable coal-power plant, under the same conditions, would cost $10 million (2,500,000), with operating costs at 0.65 cents per kWh, taking the price of coal producing 13,500 B.Th.U. at $3.50 per ton at mine and $7 per ton delivered. Appropriate stress is laid on the fact that the industrial use of atomic energy is in its infancy, and that lower costs of nuclear power plants can best be attained by an extensive programme of research and development.

The Steel Board

PRESS comment on the composition of the Steel Board (which, it may be noted, is not yet complete) has been revealing, not to say entertaining. "City" interests claim that the appointments are "political"; more moderate opinion takes the line that a considerable degree of impartiality has been used in making the appointments. We are distinctly inclined towards the latter view. Two members of the Board have been drawn from the employers' side of the industry, two from the trade unions concerned: the chairman is independent (though he may certainly be classed as an industrialist), while the Treasury representative may also be reckoned as independent, and a similar status will be required of the missing member, we presume. To those who complain that control of the industry is to be taken away from men who have long experience of it (*i.e.*, the Iron and Steel Federation), and that undue weight has been given to the trade union side of the question, we would suggest a Fabian policy. In present circumstances it is inevitable that the trade unions should have a greater share in the governing of the industry than previously; but neither Mr. Callighan nor Mr. Lincoln Evans can be described as a political firebrand. There is, moreover, no reason to suppose that Sir Alan Barlow will attempt a reversal of the previous attitude of the Treasury, which has been consistently friendly to the Federation. As we see it, the great thing is that *something* has been done to get this cardinal industry going at full steam. There has already been nearly five months' delay since the first announcement of nationalisation was made. And, as we have already pointed out, the Board is still not complete. In the present instance, we do not believe that the delay has been entirely the Government's fault; but their reputation for getting things done quickly is not so high that they can afford to miss any opportunity for decisive action.

Wood Chemistry in Russia

ONE direction in which chemical technology in Russia is expected to develop is evidently in the improvement of processes dealing with the chemical usage of wood and its residues, an important source of raw materials in an area so rich in forests as is the Soviet Union. In the latest five-year plan, the Chief of the Central Administration of the Wood Chemical Industry of the U.S.S.R. has published figures indicating the value of wood from his point of view, claiming that one cubic metre of wood processed chemically yields, besides charcoal, some 40 kg. of chemical products. Wood-tar residue appears to have become a basic ingredient for the manufacture of many chemicals in Russia, and wood-tar oil is stated to be excellent for stabilising petrol produced by cracking, superior indeed to the synthetic inhibitors used in America, as well as being cheaper and simpler to manufacture. Pitch, as a binder for moulds, has already replaced starch and molasses at many foundries. A new discovery on the part of Russian wood

chemists is pyrocatechin, which is stated to provide the most suitable material for dyeing furs black. Intensive development of the dry distillation of wood and the manufacture of rosin and turpentine are envisaged during the five-year period, while, in an entirely different direction, bearings produced from impregnated wood, subjected to heat and pressure, are claimed to be more durable than bronze bearings, and to be especially suitable in under-water applications.

Linseed Oil Surprise

PUTTING up the price of linseed oil to more than double what it was, as announced in THE CHEMICAL AGE last week, has apparently come as a shock to people in the paint industry, particularly as they had been given no inkling of any such increase. When considering the present figure of £135 per ton, it is almost impossible to realise that the average London price in 1939, up to the outbreak of war, was but £24. The following year the Government spot selling price reached £43 10s., and this figure remained more or less the same for a couple of years; then it went up to £48 17s. 6d. In 1944 the price rose to £61, and, before the latest increase was announced, it went up to £65. So far as paint consumers are concerned, the increase will probably work out at between 6s. and 7s. a gallon, and it is being pointed out that this will add considerably to the bill for reconversion and rehabilitation in industry generally. Such a considerable increase could not have come at a worse time.

Free Market Wanted

AMONG the reasons given by the Government for embarking on the policy of buying commodities in bulk were that prices would be kept steady and that adequacy of supply would be ensured, but the latest move has made the first of these arguments appear painfully thin, while nothing has been said to indicate that there will be larger or more assured allocations. Indeed, the present allocation to the paint industry of 49,500 tons a year is woefully inadequate. When a delegation from the industry met Mr. Belcher, Parliamentary Secretary to the Board of Trade, at the end of July, they pointed out that the industry required 90,000 tons a year, and could use 120,000 tons. The return of a free market is now being more strongly urged than ever, it being considered in trade circles that this unexpected and spectacular advance in the price of an essential raw material condemns still more the Government's policy of bulk-purchase.

The Advance of Chemistry

ON all sides there is evidence of the advance of chemistry. Much of this progress is due to the mutual exchange of information and in this connection the reports of the survey teams of scientists and others now inspecting German plant and interviewing workers are of especial importance. Some of the teams are American, others British, and they work independently, but the information gleaned is shared between the two countries, and, apparently, is soon to go further afield. Addressing a meeting of Australian scientists at Sydney recently, Mr. Bradley Dewey, president of the American Chemical Society, alluded to the importance of the reports and said he understood they would soon be available to Australia. Going on to speak of the possibility of the swift advance of chemistry being checked by inability to find enough men of adequate training and education to carry it on, he deprecated undue alarm, declaring that there were many evidences that the younger generation recognised the opportunities which chemistry and chemical engineering offer.

A New Approach

MR. DEWEY was of the opinion that as rapidly as educational institutions could train them, there would be a supply of young men to support and advance what has already been undertaken, but he added the hope that before long there would be an entirely new approach to scientific and technical training in the schools. "All of us older men have long realised," he said, "that the barriers are breaking down, or have broken down, between classical chemistry and classical physics. The one, we know, blends into the other even as engineering merges into both. I know many of you will share my hope that we shall see a basic training in the future in which science will first be taught as a whole—as the complete knowledge of material things that it is. And when this broad science has been understood by the student, it will be time enough for him to concentrate upon the specialities we shall term 'chemistry' and 'physics.'"

Some Chemical Aspects of Atomic Energy

The Present Position and Possible Applications

by GUY G. S. DUTTON, B.A., A.R.I.C.

THE publication of the Smyth report[1, 2] last year has focussed the attention of the world on the possibilities of using the energy produced in atomic fission for various industrial purposes besides its war-time application for atomic bombs.

The present-day conception of an atom is that it contains a central nucleus in which is concentrated the majority of its mass. Surrounding this nucleus are electrons which are arranged in several concentric shells. The mass of the nucleus is made up of neutrons and protons each of which has a mass slightly greater than unity, but the proton also has a unit positive charge whereas the neutron has no charge. Since an atom is electrically neutral the number of planetary electrons must be equal to the number of protons since each electron has one negative charge. The mass of an electron is only 1/1840 that of a proton and so if this is neglected the atomic weight of an atom is the sum of the weights of the neutrons and protons in the nucleus. The atomic number corresponds to the number of protons, which we have seen is the same as the number of electrons.

Radioactivity

The phenomenon of radioactivity was discovered in 1896 by Becquerel, who observed that salts of uranium were capable of affecting a photographic plate even when this was wrapped in black paper. The celebrated work of the Curies showed that the material in the uranium affecting the photographic plate was a new substance which they called radium. At the same time another radioactive substance was discovered, and was called polonium, after Madame Curie's native country, Poland. A little later a third radioactive substance was isolated and this was called actinium.

Radioactive materials are so called because they spontaneously decompose with the emission of various particles. The three main types of particle which are emitted in this manner are the alpha particle, the beta particle, and gamma rays. It has been shown that an alpha particle is a doubly charged helium atom, that is to say it has a mass of four units with two positive charges. The beta particle has been identified with the electron and so it has a unit negative charge and negligible mass. The gamma rays are electro-magnetic vibrations similar in nature to X-rays, but of much shorter wave length.

The isolation of these radioactive products led to the idea that the alpha particle in particular might be used for bombarding other atoms and thereby producing atomic transmutations. This was first achieved by Rutherford in 1919, who bombarded atoms of nitrogen with alpha particles and found that a small amount of oxygen was produced. Since an alpha particle is doubly charged and the nucleus of an atom is also positively charged there is bound to be electrostatic repulsion between the two. Consequently the number of direct hits by an alpha particle on the nucleus of any atom is small.

Discovery of the Neutron

The discovery in 1932 by Chadwick of the neutron was a great step forward. Although this particle has only one-quarter the mass of an alpha particle it has no charge and can therefore enter more freely into the interior of an atom. As an example of a bombardment reaction using neutrons we may take the case of the reaction between protons and neutrons, thus: $2\ {}_1H^1 + 2\ {}_0n^1 = {}_2He^4$. Considering the masses of the particles on the left hand side we have 2.01794 for the neutrons and 2.01516 for the two protons. On the right hand side we have one helium nucleus with a mass of 4.00388. It would appear that 0.02922 units of mass have been "lost" in the course of the reaction. It was, however, propounded by Einstein that energy and mass are equivalent. His relationship states that $E = mc^2$, where E is the energy in ergs if m, the mass destroyed is in grammes, and c, the velocity of light, is 3×10^{10} cm. per sec. The mass which is apparently lost in a reaction of the above type appears as energy according to this relationship and it may be calculated that the production of one gramme of helium by this method will liberate 165×10^{12} cals.

In the production of helium by this method the neutrons must be supplied from an outside source and as soon as the supply is cut off the reaction will cease. The next important discovery in laying the foundations for atomic energy was made by Hahn and Strassman, who found that bombarding uranium with neutrons caused the uranium atom to split into two portions of approximately equal mass, in the course of which reaction more neutrons are formed. Here we have the very important difference between this reaction and the bombardment

of protons with neutrons to produce helium; the former is self-supporting because of the production of more neutrons, while the latter reaction ceases as soon as the external supply of neutrons is withdrawn.

Natural uranium consists of three isotopes of masses 234, 235 and 238. Of these the U234 is of no importance from our point of view since it is present in only very small amounts and takes no part in nuclear reactions, while U235 and U238 are present in the proportion of 1 to 140.

Further work showed that the U235 is the important isotope in producing a chain reaction, since it is this which undergoes fission into two particles of different masses with the simultaneous production of more neutrons, the number of which may vary from one to three per fission. These neutrons have very high energies (of the order of 200 Mev.), but it is only neutrons of low energies (about 0.025 Mev.) which are effective in bringing about fission of the U235 nucleus. These neutrons are sometimes referred to as thermal neutrons, since their energy is equivalent to that produced by thermal agitation. It is obvious then, that if a chain reaction is to be made possible, these high-energy neutrons must be slowed down in order to produce further fissions. This may be accomplished by a series of elastic collisions. Since the transfer of energy is greatest when a neutron collides with an atom having approximately the same mass as itself, it would appear that hydrogen would be the best material to use. Any material which is used for slowing high speed neutrons is known as a moderator, but the choice of hydrogen for this purpose is ruled out owing to its great affinity for absorbing neutrons. Other materials which have been suggested as moderators are deuterium, in the form of heavy water, beryllium, and graphite.

Factors Influencing a Chain Reaction

From what has been said above it is clear that a chain reaction becomes possible by using a lump of natural uranium which contains the fissionable U235, in conjunction with a moderator to slow down the fast neutrons produced in fission to those of thermal energies. This, then, is the essential requirement for constructing an atomic pile. Just as hydrogen cannot be used as a moderator owing to its power of absorbing neutrons, so also other substances are encountered as impurities in the uranium and graphite which will absorb neutrons. It has been stated that 1 to 3 neutrons are produced per fission, and since it is essential that at least one of these neutrons be available to promote further fissions, it is advisable at this point to consider the factors influencing the useful life of a neutron. There are four ways in which a neutron may react. It may: (1) be absorbed by U235 producing further neutrons; (2) be absorbed by U238; (3) be absorbed by impurities in the uranium and the moderator; (4) escape completely from the uranium. It is clear that for a chain reaction to take place the gain in neutrons by the first process must be greater than the loss by all the other three processes combined. This fact has given rise to the use of a constant k, known as the reproduction factor, which is defined as the ratio of the number of new neutrons produced in fissions to those originally present.

Purity Requirements

In order to reduce the loss of neutrons by any of the three means listed above, the greatest attention must be paid to the purity of the materials used. It would appear at first sight that it would be helpful to separate the U235 from the U238, but although this is desirable from the point of view of an atomic bomb it is not essential in the construction of an atomic pile. Although U238 does not undergo fission when bombarded with neutrons it will absorb a neutron and be converted to an isotope of mass 239. This is unstable and by emitting a beta particle will pass to an atom of mass 239 and atomic number 93. This is known as neptunium, which is also unstable, and by the loss of another beta particle passes to plutonium of mass 239 and atomic number 94. Since plutonium also undergoes fission on bombardment with neutrons its production will help to keep the chain reaction in operation. Thus we see that it is not necessary to separate the isotopes of uranium but it is essential that the uranium metal used is of very high purity.

There are two main sources of pitchblende, which are situated near the Great Bear Lake in Northern Canada, and in the Belgian Congo. After the uranium has been extracted from the ore it is best purified by conversion to uranyl nitrate. This compound has the property of being soluble in ether and so if a solution of the impure nitrate is ether-extracted the pure salt will dissolve in the solvent (together with a little vanadium), leaving the impurities in the aqueous layer.

It has been estimated that a neutron makes 200 collisions with the moderator and travels 2.5 cm. before it is slowed down to an energy level suitable for producing further fissions. It should be evident from these figures that the purity of the moderator is of great importance. Of the moderators already mentioned the world's stock in 1940 of heavy water was only about 500 lb., a quantity quite insufficient for the construction of a pile. Similarly the stock of beryllium metal was extremely low and the cost of production very high. Attention was therefore turned to graphite as the most

convenient material to use as a moderator. Commercial graphite electrodes from which the blocks of graphite moderator are made are manufactured by graphitising petroleum coke, which is pressed into bars. Graphite made in this manner will contain a certain amount of residues from the petroleum products, but since these may usually be eliminated by heating to a higher temperature, the first attempts to improve the quality of the graphite were concerned with the elimination of the boron. Commercial graphite normally contains one part in 500,000 of boron and although this quantity is acceptable for most purposes it is too much when the graphite is to be used as a moderator. This is because boron has a very high affinity for neutrons and consequently even a small amount will tend to reduce the value of k below unity. It is significant that within a year the purity of the graphite had been so improved that the degree of neutron absorption was reduced by 20 per cent.

It is interesting to note the many methods of analysis which were employed in order to check the purity of each batch of materials for use in the pile. The techniques employed included the usual ionic analyses in conjunction with spectrophotometry and polarography, but since it is not the presence of any one impurity which is injurious, but the combined effect of all the impurities, these tests were supplemented by functional trials. These were carried out by inserting a sample of the material under test in a chain-reacting unit and measuring the neutron density at fixed distances from the neutron source.

The escape of neutrons may be governed by altering the size of the lump of uranium. If the uranium is considered to be in the shape of a sphere the loss of neutrons will be dependent on the surface area, proportional to r^2, while the capture of neutrons producing fission occurs throughout the volume of the material and is therefore proportional to r. It is evident, therefore, that it is possible to have a piece of uranium of such a size that these two effects are balanced. This is denoted by the term "critical size," which is defined as the size for which the production of free neutrons by fission is just equal to their loss by escape and non-fission capture.

Construction of an Atomic Pile

It has been noted that a pile consists essentially of uranium, which contains U235, and a moderator, and that the purity of these materials is of prime importance. The question now arises as to how, given suitable materials, they may be assembled in order to generate energy which can be used for industrial purposes. The first pile to be built consisted of seven tons of uranium metal in the form of lumps inserted in a regular manner in an eight-foot cube of graphite. During the course of the chain reaction fission products are produced from the U235, and since most of these are radioactive and capable of absorbing neutrons there comes a time when the value of k may fall below unity. This may be overcome by periodically removing the lumps of uranium and inserting fresh metal. If an atomic pile is likened to a currant cake in which the currants represent the lumps of uranium it will be seen that it is difficult to remove the uranium without disturbing the rest of the pile. To overcome this difficulty the uranium is inserted in the form of rods, known technically as slugs. By this means it is comparatively simple to push out an old slug and replace it with a fresh one.

The process of fission occuring in a pile generates a large quantity of heat. This is the energy produced by the apparent loss of matter, according to Einstein's equation. In order that the pile may do useful work this heat must be harnessed. Two cooling materials were originally proposed. These were helium and water. The piles which have been built and operated up to the present have all been water-cooled. The decision to use this method was taken mainly on account of the hazards involved in case any of the helium should leak away, carrying radioactive fission products.

Cooling Methods

Naturally, the most efficient way of cooling the uranium slugs is to have the water circulating in direct contact with them, but this is impractical since the uranium will react. It is therefore necessary to sheathe the uranium slugs in some manner in order to protect them from corrosion. The choice of material to be used for protecting the slugs is governed by two main factors. The first is that the material used must not be attacked by water, and secondly, it must not readily absorb neutrons or disintegrate under the influence of the gamma rays present in the pile. Considerations of these limitations restricts the choice of materials to Pb, Bi, Be, Al, Mg, Zn, and Sn. The materially finally chosen was aluminium, and the slugs were protected by being sealed inside aluminium cans. This method of protecting the slugs is the result of much experimenting with other processes, such as metal spraying, all of which proved inferior to the canning method.

If pipes to carry the cooling water are to be inserted into a pile and yet the pile is still to remain self-supporting, *i.e.*, for k to be greater than unity, it means that initially the pile must have been producing more neutrons by fission than were needed just to maintain the chain reaction. If for every fission by a neutron two more neutrons are produced, these two, when they cause further fissions, will produce four neutrons,

and soon the process will get out of hand and become explosive. This is obviously undesirable in a pile designed for the production of a steady quantity of energy for industrial purposes and it is necessary to have a means of controlling the number of neutrons available for producing fissions. This is done by inserting into the pile rods of material which have a strong absorption for neutrons. The materials most commonly used for this are cadmium or boron-steel. The distribution of these rods in the pile, and their size, are arranged so that when they are pushed right into the pile the value of k is reduced well below unity, and when they are pulled out it will rise above unity, thus allowing the pile to be run at different energy levels. For a pile to run at a constant energy level the value of k should be 1.0. It is possible for an operator to acquire, in a few hours, sufficient experience to keep the output level. In more recent plants the movement of the control rods is governed automatically by instruments which measure the value of k; in this case all the operator has to do is to watch the control dials.

The water used for cooling will become heated in its passage through the pile and this heat may be utilised in the form of hot water or low-pressure steam for process and space heating, but neither of these methods is likely to be of much industrial importance. More important applications are for generating electricity either by the heating of air to drive a gas turbine or for a high-pressure indirect steam generator to drive a steam turbine[3].

Potential Energy of Fission Reactions

It is convenient at this point to compare the energy available in an atomic pile with the energy to be derived from more normal sources, such as coal, and at the same time it should be borne in mind that so far atomic piles have only been run with the sole idea of producing plutonium, in which case the energy generated has been dissipated as waste heat.

(It was recently announced at a meeting of the Atomic Scientists' Association that a pile is at present being constructed in the U.S.A., and that it is hoped to drive a turbine with it within a year.)[4]

It has been stated earlier that it is only the U235 isotope which undergoes fission and that this is present in natural uranium to the extent of one part in 140, or 0.7 per cent. It can be calculated that if one pound of uranium be completely destroyed by fission the energy released will be 3,000,000 times that produced by burning the same quantity of coal. When the factor of 0.7 is taken into consideration this figure is reduced to 20,000, so that, in round numbers, 1 lb. of natural uranium is equivalent to 10 tons of coal. The price of uranium metal in a state of purity suitable for use in atomic piles has already fallen from £200 to £4 per lb., and it is reasonable to suppose that this figure will be reduced still more as manufacturing experience and the demand increase. In the light of these figures it would appear, then, that any industry depending on coal as its main source of energy may expect, in the course of the next few years, to obtain this energy for a fraction of its present cost from atomic sources.

As an example of the fallacy of this line of thought let us consider the generation of electric power since, in this country, this industry relies almost entirely on coal as its source of energy. In 1938 the Central Electricity Board published the following itemised account of the cost of electricity production, taking coal at £1 0s. 3d. a ton. Fuel accounted for 28 per cent. of the cost; capital charges 28; salary, wages, and maintenance 10, and profit 34 per cent. Consideration of these figures will show that even if the cost of fuel is considerably reduced it will not greatly affect the cost of electricity. On the other hand, the plant needed for generating atomic energy and the special precautions to be observed in handling radioactive substances may well cause an increase in capital charges and maintenance. It would therefore appear that the cost of generating electricity is not likely to be fundamentally altered by the discovery of atomic energy. On the other hand, what this method of producing energy has done is to make it possible to generate electricity where supplies of coal do not exist, and it is likely that a method will soon be developed whereby air can be used as the coolant, thus dispensing also with the need for an adequate water supply.

The possibilities of such an arrangement have many far-reaching applications. Among these may be mentioned the fact that it will now be possible for industries to be situated without regard to supplies of coal and water for the provision of power, and this may in future be a factor in helping to even out the distribution of labour in this country. A second application that may be noted is that if new deposits of minerals are found in desert areas it may become a practicable proposition to work them.

Some Drawbacks

So far we have reviewed the construction of an atomic pile for producing energy, the materials required and their methods of purification, but nothing has yet been said about the many hazards and difficulties of operation which are to be encountered. It has already been noted that the materials to be used have to be specially purified and so we cannot expect many piles to be constructed in the near future until methods of producing these materials in large quanti-

ties, in the required state of purity, have been perfected and the necessary plant set up. As an indication of the amount of material needed for a pile it may be stated that the first pile ever to be operated contained seven tons of uranium imbedded in an 8 ft. cube of graphite, but even these amounts of materials only produced 200 watts.

Besides the quantities of materials required, the size of the pile must be taken into consideration. As can be judged from the figures quoted above, the size, even for moderate outputs of energy, is unwieldy, using graphite as a moderator, but if this is replaced by heavy water the size can be materially reduced owing to its much greater efficiency in slowing up high-speed neutrons. It is interesting to note in this connection that when an experimental pile, using heavy water, was built, the chain reaction became self-supporting when only two-thirds of the calculated quantity of water had been added. We see then that there is scope in the chemical industry for processes designed for the economical production of pure uranium, graphite, and heavy water.

Harmful Radiations

When the U235 undergoes fission the two particles which are formed, in addition to the neutrons, are radioactive. This means that as soon as a pile is put into operation radioactive materials are produced and these in turn give off harmful radiations. Just as radium for clinical use is enclosed by a thick shield of lead when not in use so also must a pile be shielded to prevent workers on the plant from being affected by the radiations. The screen normally used consists of a thick wall of steel or concrete, and even for a pile of modest energy output this shield will weigh something of the order of 50 tons. This, then, would appear to shatter illusions which seem prevalent at the present time that cars and aeroplanes will soon be running on atomic energy. There is, however, one form of transport which may be able to utilise atomic power, and that is ships. Taking the case of the *Queen Mary*, which uses 6000 tons of fuel in crossing the Atlantic; it may be, that allowing for the weight of the shielding required, a saving in weight will be effected.

The fact that the fission products produced in the pile are radioactive leads to other problems, among which two may be mentioned. The water flowing through the pile as coolant will become radioactive and cannot, therefore, be discharged immediately as this would endanger both human and animal life. To overcome this the water must be kept in reservoirs or a lake until the radioactivity has died down. It must be remembered that radioactive decay is a spontaneous process and its rate cannot be altered by any of the usual agents.

Secondly, no engineering plant can run for ever without attention, and efficient maintenance is essential. Whereas, if a piece of machinery is sprayed with poison gas, it is a relatively easy matter to decontaminate it by means of a squad of men dressed in protective clothing, the matter is much more complicated in the case of a radioactive pile. The only known method, at the moment, for dealing with this problem is to leave the pile until it is safe to approach. Since the half-life of some of the fission products is quite long this means that the pile will be lying idle for some time. One way of overcoming this is to have a battery of piles, some of which are always "cooling off," but this is likely to lead to an increase in running costs.

Other Fission Products

There is, however, a bright side to the production of these radioactive fission products and that is that among them is iodine; and radioactive carbon, phosphorus, and sulphur can be made in a similar way by neutron bombardment. The implication of this is important in biological work for elucidating points of interest in connection with tissue growth and the mode of action of drugs. Radioactive carbon will also provide the organic chemist with a useful tool in investigating the mechanism and course of reactions. Only very small amounts of these tracer elements are required since, for a radioactive element with a half-life period of 100 hours, 10^{-15} of a gram can be detected with ease. It is more likely that great strides will be made in this field in the near future rather than in the production of atomic energy.

Just as the discovery of steam did not at once give us long-distance trains travelling at high speeds, nor the discovery of the internal combustion engine aeroplanes travelling at speeds approximating to that of sound, so it is unreasonable to expect that a self-supporting atomic pile, first operated on December 2, 1942, will immediately revolutionise our way of living. Advances there will no doubt be, and although an atomic pile generating about half a million kilowatts is by no means outside the bounds of possibility, it would be idle to suppose that it will be built overnight; but when it comes it will provide a large contribution to the four million kilowatts of electricity at present generated in Great Britain. Most of the chemical industry depends on power in one form or another, and the advent of cheap and adequate supplies of electricity will be of far-reaching importance.

REFERENCES

[1] Atomic Energy, H. D. Smyth, H.M.S.O., 1945.
[2] For a full summary of this report see The Chemical Age, 1945, 53, pp. 359, 385.
[3] *Power Plant Engineering*, 50, No. 4, p. 81.
[4] *Nature*, August 24, 1946, p. 255.

Iron and Steel Board

Names of the First Members

NAMES of the first members of the Board set up to supervise the development and reconstruction of the iron and steel industry were announced by the Ministry of Supply on Friday last week as follows: Sir Archibald Forbes (chairman), Sir Alan Barlow, Mr. A. Callighan, Mr. Lincoln Evans, Mr. G. H. Latham, and Mr. R. Mather.

Mr. A. C. Boddis of the Ministry of Supply has been appointed secretary of the Board. An additional member with experience of general industry is to be appointed and his name will be announced shortly.

Sir Archibald Forbes, who was formerly a member of the firm of Thomson McLintock and Co., Ltd., became a director of Spillers Ltd., in 1935, and was released in 1940 to join the staff of the Air Ministry. After a period as Deputy Secretary to the Ministry of Aircraft Production, he subsequently took over also the post of Controller of Repair, Equipment and Overseas Supplies.

Sir Alan Barlow, Bart., has been a Joint Second Secretary of the Treasury since 1942.

Mr. A. Callighan became national president in 1939 of the National Union of Blast Furnacemen, Ore Miners, Coke Workers and Kindred Trades, and became general secretary of the union in November of that year. He has had long experience of trade union activities.

Mr. Lincoln Evans became assistant general secretary of the Iron and Steel Trade Confederation in 1936 and succeeded Mr. John Brown as general secretary of the Confederation early this year. He is a member of the T.U.C. Advisory Committee on the coal-mining industry.

Mr. G. H. Latham has had more than 40 years' experience with the Whitehead Iron and Steel Company, Ltd., of which he is now chairman and managing director. He was managing director of Richard Thomas and Co., Ltd., for a period. He is president-elect of the British Iron and Steel Federation, vice-president of the Iron and Steel Institute, and Technical Adviser for the steel industry on the Finance Corporation for Industry.

Mr. Richard Mather is chairman and managing director of the Skinningrove Iron Company, Ltd., and a director of Pease and Partners. He was technical adviser to the Indian Tariff Board in 1923-24, and again in 1926-27, and was technical director of the Tata Iron and Steel Company from 1930-40.

Duties of the Board

The main duties of the Board will be:

(a) To review and supervise programmes of development needed for the modernisation of the iron and steel industry and to watch over the execution of approved schemes in such programmes.

(b) To supervise as necessary the industry in current matters, including the provision of its raw material requirements, and the administration, under powers delegated by the Minister, of such continued direct control as may be required over the production, distribution and import of iron and steel products.

(c) To advise on general price policy for the industry and on the fixing of prices for controlled products.

The salary of the chairman will be £8500 per annum, and the other members of the Board, who are on a part-time basis, will each receive £1000 per annum.

Magnesium Alloys

Technique of Gas Welding

WITH the growing importance of the applications of light alloys to the engineering industries, special interest attaches to a report, "Technique for the Gas Welding of Magnesium Alloys," issued by the British Welding Research Association. Magnesium alloys proved their worth during the war and many current developments in industry would suggest that more will be heard of them in the future. The publication just issued is a memorandum prepared by a joint committee of the British Non-Ferrous Metals Research Association and the British Welding Research Association on Fusion Welding of Magnesium-rich Alloys.

It is pointed out that the readiness and ease with which magnesium - 1.5 per cent. manganese alloy may be welded renders possible the construction of complicated assemblies, but to achieve that most advantageously the designer must make adequate use of all available forms of the metal, that is to say tubes, extrusions, sheet, etc. Particulars are given of design, edge preparation, setting up, manipulation, and finishing and protective treatment, including removal of fluxes, hammering, chemical cleaning, chromating, painting and temporary protection. An outline is given of the properties of magnesium affecting welding technique, the effect of the composition of the alloy on welding behaviour, notes on the welding flame, the flux and welding rods. Of special interest are references to weld defects and inspection and testing. The appendix gives details of chromating treatment. There are several excellent illustrations.

Copies of "Technique for the Gas Welding of Magnesium Alloys" may be obtained (2s. post free) on application to the Director of Research, British Welding Research Association, 29 Park Crescent, W.1.

India's Scientist-Builder

Sir Shanti Swarup Bhatnagar, O.B.E., D.Sc., F.R.S.

by CHANDRA KANT

Sir Shanti S. Bhatnagar

NOT least among India's leaders on whom has devolved the heavy responsibility of shaping the destiny of the country in some respect or other is the 51-year-old scientist and Professor of Chemistry, Sir Shanti Swarup Bhatnagar, who is the only Indian chemist elected to the Fellowship of the Royal Society of London. In Indian science to-day he holds a key position, inasmuch as it is not confined to purely academic or university work, but comprises the all-important organisation and development of scientific and industrial research for national welfare. Indeed, it is in this latter respect that he is more widely known in India and outside, and is chiefly responsible for evoking world-wide interest in the industrial potential of India.

Sir Shanti Swarup is the Director of Scientific and Industrial Research and Principal Scientific Adviser to the Government of India. In this capacity he played a vital role in the scientific war effort of the country. In 1940 he organised the Council of Scientific and Industrial Research; harnessed scientific resources of India at a critical period in the history of the country, indeed of the whole world: developed numerous industrial processes for the manufacture of much-needed goods for the prosecution of the war; co-ordinated the work of more than 100 Indian research workers and gave impetus to Indian industry through research. It is through his untiring and ceaseless efforts that Indian industrial sciences have earned recognition at international level; and, through his vision, initiative and scientific achievements, the country has realised the importance of research for progress. His achievements were honoured by the award of a knighthood in 1941.

The most outstanding effort through which Bhatnagar has set out to serve his country is in industrial chemistry and the organisation of scientific and industrial research. There were many personal circumstances which moulded his career in this respect, starting from childhood. Even at the early age of eleven he had to become self-supporting and see himself through school by winning scholarships and doing odd jobs for a little money. In his undergraduate days he worked out a successful formula for the manufacture of gelatin duplicating pads for a Lahore stationer and earned his examination fees. The really big chance, however, came in 1935, when he was director of the Punjab University chemical laboratories. The Attock Oil Company approached the university with one of their insuperable problems and one on which they had spent much money and effort—the coagulation of mud in drilling operations when salt deposits were encountered. The university chemists put forth various suggestions for overcoming the difficulties which, however, were not quite feasible. Dr. Bhatnagar (as he then was) immediately realised that it was a simple problem in colloid chemistry, a subject dear to him, and could be solved by protecting the colloidal mud by means of protective agents, especially Indian gums. Before the day was over he had demonstrated his idea in the laboratory; before the week was over it was employed in the oilfield with great success. His solution attracted world-wide interest, especially among petroleum technologists, and this first big success gave birth to a highly flourishing school of applied research at Lahore, covering all branches of chemical industry.

The Steel Brothers Company offered him a lac and half of rupees as reward for the successful investigation of their problems, and Dr. Bhatnagar made over the whole of this amount to the Punjab University for the encouragement of applied research.

It was in a most crucial period of the country's history that Dr. Bhatnagar showed his abilities as a great scientist and builder, and set the country on the path of industrial progress. In 1940 the conditions created by the outbreak of the war suddenly left even the established industries of the country bereft of some of the commodities essential for their continued functioning. These industries had come to depend on other countries, countries not even within the British Commonwealth of Nations, for the supply of such commodities. Many sources of supply to India of finished products were either stopped entirely or much curtailed. The Government also felt at that time that the commodities essential for the prosecution of the

war could not be produced in the country and could not be obtained from outside without serious difficulty. Very soon India had to occupy a key position as supply centre for the whole of the Middle East and Far East.

A Central Research Board

As the situation became acute, it came to be realised that planned industrial research on the many problems of the chemical, metallurgical and engineering industries under Indian conditions was almost completely lacking, and that to make India industrially self-sufficient, also an effective source of war supplies, a Central Research Organisation should be established immediately. This serious gap in the country's industrial development was filled by the creation of the Board of Scientific and Industrial Research by Government in 1940, and Dr. Bhatnagar was called upon to organise, direct and co-ordinate the work of the Board. The magnitude of the responsibility devolving on him was overwhelming, as everything had to be done right from scratch. But Dr. Bhatnagar saw in this his life's biggest chance to serve the country through scientific research and took it up with the zeal and devotion characteristic of a builder. Accompanied by a batch of trained workers from Lahore, he went to Calcutta, started his laboratories and infused new life into the scientific workers of the whole country.

Thereafter, the story of his contributions to the cause of Indian industry is largely the story of the achievements of the Council of Scientific and Industrial Research, which played such a notable part in winning the war and latterly in India's post-war industrial development. At one time more than 50 research chemists and physicists worked in his laboratories, under his direction, covering diverse fields of industrial research—plastics, paints and varnishes, oils, heavy and fine chemicals, fertilisers, pharmaceuticals and drugs, lubricants, etc., and contributed to the successful investigation of more than 100 research problems. New aspects of research, some of them unique in the whole world, were opened up and results of far-reaching importance were obtained. His scientific advice was sought for by the R.A.F., U.S.A. Air Forces, supply and food departments, and several other defence organisations of the Government. Under his direction the work of the Council expanded phenomenally in every branch of science and industry, and the Council became the premier scientific organisation of India. He organised surveys of Indian industries and raw materials, and gathered much valuable information. He established scientific liaison with the advanced countries of the world and raised Indian industrial sciences to the international level.

The organisation of post-war research in India is yet another mission in his life to which Sir Shanti is now devoting all his attention and energy. Even within this short period of five years since the inauguration of the Council, he has made the public and the Government keenly alive to the importance of research to national progress. As a result of his efforts the Government have sanctioned one crore of rupees for the further development of scientific research in India. Seven national laboratories—National Chemical Laboratory, National Physical Laboratory, National Metallurgical Laboratory, Fuel Research Institute, Central Glass and Ceramic Research Institute, Road Research and Building Research Institutes—have been planned to be established in the immediate future. What these laboratories would mean to the country needs no explanation. They are the vital arteries of the country's progress, and the man responsible for them is a national asset. It is, indeed, a fitting recognition of his work that the British Society of Chemical Industry elected him an honorary Fellow in 1945.

Educational Work

On return to India in 1921 from England, with high academic honours and experience in chemical research at the London University, Bhatnagar was appointed University Professor of Chemistry in the Benares Hindu University. He served this university until 1924, when he joined the Punjab University, his *alma mater*, as University Professor of Physical Chemistry and Director of University Chemical Laboratories. It was here that he built up an expanding school of chemistry, now so widely known. He attracted to Lahore a very large number of students, many of whom now occupy professorial chairs in various Indian universities and important places in research institutes. It is not strange that Dr. Bhatnagar, with family traditions of culture and learning, and with the inspiration derived from great masters, devoted a good part of his life to the cause of education. In recognition of his services to the cause of education, Sir Shanti was made a Fellow of the University College, London, last April.

Bhatnagar's contributions to science have been from two points of view—the advancement of scientific knowledge, and the utilisation of this knowledge for material progress. In both these he has been a great Indian pioneer. His work in the field of pure or academic research is apt to be overshadowed by his outstanding work in industrial chemistry, which has attracted wide public interest and has brought him fame, but the former is no less important and praiseworthy. Indeed, it is his firm hold on fundamental or theoretical sciences that has helped him to

serve the cause of applied science. His contributions to magneto-chemistry are both impressive and brilliant, and a comprehensive review of his work on this subject, with scores of references to the applications of the precision magnetic interference balance developed by him, has appeared in the Annual Reports on the Progress of Chemistry issued by the Society of Chemical Industry. The balance has been manufactured by Messrs. Adam Hilger & Co. His monograph on magneto-chemistry is recognised as a standard work on this most intricate subject. His contributions to colloid chemistry, photo-chemistry and the study of chemiluminescence, carried out over more than 20 years, have played no small part in the development of these subjects.

Personal History

Sir Shanti Swarup is the eldest son of an ancient cultured Hindu family of Kayasthas, whose earlier members held high office in the Moghul Court. His father, a meritorious graduate of the Punjab University in English and history, became one of the earliest followers of Brahmo Samaj, the great Hindu reformist movement started by Raja Ram Mohan Roy. He was on this account disinherited from family property, not a rare thing in the India of that period; and instead of joining judicial or executive service, which was the family tradition, became the headmaster of a high school. He died when Sir Shanti Swarup was only eight months old.

Education came the hard way to young Bhatnagar in the circumstances in which he found himself at a very early age, without any means of support. He had to struggle hard to pay for his education—by doing odd, part-time jobs and by winning merit scholarships. He found, however, in one Mr. Raghunath Sahai a real friend, philosopher and guide. Mr. Raghunath Sahai was a class-fellow and friend of Shanti Swarup's father, and one of the best-known educationists of his time. Bhatnagar later married Mr. Raghunath Sahai's daughter, Lajjawati, at the age of 20.

As a student in the school and college, Bhatnagar topped the classes and won the praise of his teachers. He evinced keen interest in science and, while still in the intermediate classes, contributed a paper on the fermentation of pomegranate juice. He had his university education first at the Forman Christian College, Lahore, and later at the Punjab University chemical laboratories. At the latter he did his first post-graduate research on the effect of adsorbed gases on the surface tension of water, which formed his thesis in part-fulfilment for his M.Sc. degree. In 1919, with the help of a scholarship from the Dayal Singh College Trust, Bhatnagar entered London University as a research scholar under Prof. F. G. Donnan. He worked on emulsions and qualified for the D.Sc. degree of London University.

During the summer vacations of 1919-21, Bhatnagar worked as a research student at the Kaiser-Wilhelm Institute, Berlin, and the Sorbonne, Paris, and came into close contact with leading scientists—Professors Haber, Freundlich, Bodenstein, Einstein, Planck, Urbain, Perrin, and others—from all of whom he derived great inspiration for scientific research. During his stay in England he held a Fellowship of the Department of Scientific and Industrial Research.

The realm of science is the realm of utility, and a scientist in the present age serves mankind most by making the most useful contribution to its material progress. At its higher levels, however, scientific pursuit is the pursuit of truth. We have seen that Bhatnagar's contributions to India's industrial progress have been great, but his researches in the theoretical sciences, it must be emphasised, are of equal significance Beyond the satisfaction of material ends man has deeper yearnings, profounder needs of the spirit. This is the reason why artists will always be reckoned the equals of scientists in the service of mankind. It is rare that both rôles are played by the same individual. In Sir Shanti Swarup, however, urge for science has not crowded out the craving for poetry. He is a poet of distinction, and to him poetry is as dear as chemistry. He is the author of over 50 poems in Urdu, many of which, especially " The Wife and the Book," " The Chemist and the Philosopher," etc., are famous for their depth of thought and feeling and for their beauty of composition.

TIMBER PRESERVATION

For the preservation of timber used underground in the Rand mines, a new vacuum-pressure plant has recently been placed in operation in South Africa. The impregnating solution contains 3 per cent. of zinc sulphate and 0.3 per cent. of triolith. Composition of the triolith is: potassium bichromate 35 per cent.; dinitrophenol 10 per cent.; sodium fluoride 55 per cent.

The method of impregnation is a three-stage vacuum-pressure-vacuum one, and it results in the complete penetration of the sapwood of the timber. The type of timber treated is mostly mixed gum and wattle of comparatively recent growth. There is little or no penetration of the heart-wood. The net liquid absorption is 0.75 to 1.0 gallons per cu. ft. of timber.

LETTERS TO THE EDITOR

B.A.C. and T.U.C.

SIR,—Mr. Sheldon leaves me even more dissatisfied with the B.A.C. than before. He still does not tell us whether his letters are officially written on behalf of the Association or not.

I said nothing in my letter about the B.A.C. having a political bias. It would not worry me much if it had. The trouble is that it hasn't got any kind of bias, except, perhaps, a bias for sitting on the fence. Why the Council of the B.A.C. should go to all the trouble and expense of holding a ballot to do something which they have not even made up their minds they want to do is beyond me.

Being a technical representative who travels a wide area and meets many chemists, I can assure Mr. Sheldon and his colleagues on the B.A.C. Council that the apparent vacillation and indecision which they exhibit does far more damage to the B.A.C. than any hint of a political bias. An association which cannot make up its mind will interest only those chemists who cannot do so either. Those who can, join either the Institute or the A.Sc.W. Those who cannot, fail to join even the B.A.C., just because they cannot.

Frankly, I would sooner see the B.A.C. go violently Communist than continue in its present sloth and torpor. As a professional body, it just isn't on the map: as a trade union, it is a farce. It has huge accumulated funds which it does not know how to use and its dwindling membership is a sad commentary on the enthusiasm which it originally displayed in 1918, and which I also recall sharing.—Yours faithfully,

NON-SOCIALIST CHEMIST.

September 7.

Industrial Jewels

SIR,—I read, with great interest, your editorial on "Industrial Jewels" (*see* THE CHEMICAL AGE, Aug. 24, p. 219), and I fully agree with your point of view that the diamond has hitherto resisted all efforts to be manufactured synthetically, having the same composition and quality as in nature.

You refer to the fact that the most remarkable piece of evidence for the correctness of Hannay's manufacture is that some of the twelve pieces in the collection of the Natural History Museum are of the "rare" structure of the type II class of diamond, being a mosaic, less perfect, type of structure than that of the more "numerous" type I diamonds. It may, perhaps, interest you that at present the type II diamond is really a more common one as its characteristics are widely known in diamonds discovered in the Belgian Congo and Sierra Leone. A great number of these diamonds are covered by a relatively thick coat and, as shown by X-ray studies, this coat reveals the properties of type II diamond. Practically all diamonds used for abrasive purposes come to-day from these mines.—Yours faithfully,

P. GRODZINSKI.

London, N.W.3. August 31.

Synthetic Caffeine

SIR,—We see in the issue of THE CHEMICAL AGE for August 31 (p. 267), under the heading "Foreign News," that you report that the Monsanto Chemical Company is erecting a plant for the synthesis of caffeine.

As a matter of form, we should like to take this opportunity of calling your attention to the fact that our company also has succeeded in effecting the synthesis of caffeine. A plant for this purpose was erected during the war, at a time when we were cut off from our normal raw materials, and we were thus able to satisfy French requirements.—Yours faithfully,

SOCIETE DES USINES CHIMIQUES RHONE-POULENC.

Paris. September 3.

Origin of "Nuron"

SIR,—References have been made in the technical Press to the effect that "Nuron," the new contact resin developed by the plastics division of I.C.I., may be derived from allyl alcohol. This is not so. Although "Nuron" is a cross-linked resin and can be used in the manufacture of many forms of laminates, it is distinct from the allyl type of contact resins produced in America. The British resin is made entirely from raw materials available in this country.—Yours faithfully,

GORDON LONG,
Press Officer,
Imperial Chemical Industries, Ltd.

London, W.1. September 4.

CHEMICAL ENGINEERING COURSES

The Ministry of Labour and National Service announces that as one method of meeting the demand for chemical engineers which modern industrial development is creating and increasing, the Ministry of Education is arranging for full-time intensive training courses in a number of technical colleges. The courses, which will last for approximately twelve months, will be open to men who have graduated in engineering, physics or chemistry or have secured the Higher National Certificate in engineering or chemistry, or who have obtained a general science degree in mathematics, chemistry and physics.

South African Chemical Notes

Extraction of Oil from Shale

(from Our Cape Town Correspondent)

A RECENT private investigation into the possibilities of extracting oil from South African shale deposits by the electro-thermal process developed by the Swedish engineer, Dr. F. Ljungström, revealed that in certain circumstances the process could be used economically in the Union.

A statement issued by the Swedish Consulate in Pretoria says that it appeared that the seams of oil-shale in the Transvaal were covered by a very thick layer of sandstone. A depth of sandstone of about 55 yards had to be penetrated before borings reached the seam of oil-bearing shale, which was about 12 yards thick at the most. Dr. Ljungström did not consider this exceptionally favourable for the process he had developed. The covering layer above the shale should not be more than 12 to 18 yards thick, and a heavier seam of shale of from 18 to 23 yards would be desirable. But the average percentage of oil in Transvaal shale was estimated at 10 to 15 per cent., against only 5 per cent. in Sweden, and he therefore considered it possible to start economic production based on 12 yards of shale covered by about 23 yards of sandstone. If the oil shale in the Transvaal yielded, when gasified, equal calorific values of gas and oil, it should be possible to produce all the electric energy needed for Dr. Ljungström's process of heating the shale by using the gas in a power station.

The report states: " Dr. Ljungström considers that to form a definite opinion of the economic possibilities of oil production from the shales of the Transvaal it would be highly desirable for a closer geological investigation to be carried out." It added that a successful oil industry depended largely on finding more favourable geological conditions than those so far revealed.

Organic Chemicals

The possibility of establishing an organic chemical industry in the Union was discussed in a paper recently read by Dr. S. R Haas, chemical engineer, at the conference on " Science in the Service of South Africa " at the University of the Witwatersrand. He said that at the moment South Africa had only two branches of the organic chemistry industry which were well developed. These were the manufacture of explosives and of chemicals based on alcohol and by-products. The remainder of the so-called organic chemical industry in the Union was actually only a " mixing " industry, which depended on materials coming from overseas. This was an unsound state of affairs. There seemed to be a reluctance to discuss the idea of an industry based on indigenous raw materials. Objections offered were that the country had a limited consuming power for such products and that coking coal deposits—the true basis for an organic chemical industry—were small. The answer lay in creating a demand for the products, and using the large deposits of low-grade coal as a substitute for coking coal. The Fischer process had proved that low-grade coal could produce a full range of organic compounds—even including, before the war, petrol at 6d. a gallon.

Anti-Fouling Paint

The efforts that are being made by the Iron and Steel Institute in England to produce a master paint that will resist barnacles are being supported by the scientists in Cape Town, in conjunction with fellow-scientists in other parts of the world. At the Sturrock graving dock and also at the old dry-dock in Cape Town, a young woman is often seen with one or two assistants scraping the hulls of ships. She is Dr. N. A. H. Millard, of the Cape Town University Zoological Department. She collects mussels, barnacles, and ugly tube-worms which foul ships' bottoms. These are studied and classified at the university, and the data are forwarded to the institute in London. Dr. Millard said that her work would continue for a year. To produce the ideal paint, the scientists in London must have all the facts of the habits in different waters of sea pests. Reports are also collected from captains of ships calling at Cape Town on the areas in which their hulls have been fouled. It costs the owners thousands of pounds a year to have the hulls scraped. Normally, ships have to enter dry-dock every nine months. It has been found that marine growth can slow up a ship by 1½ to 2 knots per hour, and that at slow speeds fuel consumption is increased by 50 per cent. Two types of paint are used on ships' hulls. One is anti-corrosive, on top of which an anti-fouling paint is used. The difficulty about the poison, Dr. Millard said, is that it must be sufficiently soluble to seep into the water and keep the organisms away. If it is too soluble the ship will lose it. A happy medium has to be found.

Dusting wattles by aeroplane for the control of bagworm will be resumed shortly. It is proposed to use Gammexane powder so as to compare its efficiency and cost with that of cryolite.

Lever's, who are South Africa's largest

soap-makers, with their main factory in Durban, have had to cut their production by nearly half owing to the world-wide shortage of oils and fats. This information was given by Mr. A. D. Gourley, chairman of the South African company. The Union used to get most of its oils and fats for manufacturing purposes from India and the Belgian Congo, he said. Now India, owing to its own shortage, had stopped exporting ground nuts. The Belgian Congo supplies go into a central pool and are allocated by the Combined Food Board in Washington. South Africa's allocation has been cut sharply. The raw materials for soap and edible foodstuffs were largely interchangeable. A large proportion of the raw materials intended for soap-making had been diverted and after being refined and treated were now being used for edible fats. The company is operating its own rationing scheme, but the Director of Food Supplies and Distribution was considering the inclusion of soap in his national rationing plan. All customers have had their orders cut down in proportion to the amount the factory is able to produce.

New DDT Tests

New extensive tests of the efficacy of DDT in combating the tsetse fly will be made in the Mkusi Reserve in Zululand in August. DDT will be disseminated in smoke form through the exhaust pipes of six aircraft. In the experiments last year the DDT was sprayed from aircraft. A preliminary test of the new method had had very promising results, a 90 per cent. "kill" being achieved, according to an official of the Onderstepoort laboratory. "The results may be the same as those achieved by the spray," he said, "but we think we will get a better penetration of the thickets with the smoke." In three months it was hoped to exterminate the tsetse in the Mkusi area. "We can tackle only the adult fly by smoke and spray, so we have to spread the tests over a sufficient period to allow pupæ to develop," the official said. Because aircraft could be used only in certain areas, further tests would be made with smoke generators on the ground.

Pigment Grinding

Rolfe Bros., Elandsfontein Rail, Germiston, Transvaal, have installed new pigment-grinding equipment at their factory which, they claim, will enable them to turn out a product at least equal to that imported. The firm is now producing a new range of chromes in three shades of green, three shades of orange, and three shades of yellow. The yellow range is sulphur primrose, lemon, and middle chromes. There is an increasing demand for such products in South Africa.

New Control Orders

Export Licensing

THE Export of Goods (Control) (No. 3), Order, 1946 (S. R. & O. 1946, No. 1473), which becomes operative on September 16, makes certain changes in the export licensing control of exports.

Among the additions to the schedule of goods requiring export licences are:

Group 3. Products of the sulphation (sulphonation) of aliphatic alcohols and aliphatic hydrocarbons, salts of such products, and mixtures (other than medicinal preparations) containing any of the foregoing.

Group 6 (1). Ores and concentrates of thorium and uranium.

Group 8. Polymers of vinyl chloride, co-polymers made mainly from vinyl or polyvinyl chloride, and compositions consisting mainly of any of these materials, in the form of rough sheet, strip, powder, granules, or chips.

Group 13. Aqueous emulsions of asphalt, bitumen, and pitch (other than coal tar pitch) whether natural or not; cadmium compounds, cadmium mass, and cadmium lithopone.

LIGHT METALS CONTROL

The work of the Light Metals Control Office of the Ministry of Supply has been transferred to the Ministry's Metal Division following the release of Mr. C. G. McAuliffe from his appointment as Controller of Light Metals. Inquiries and correspondence should be directed as follows: Metal Supplies—Ministry of Supply, M.4 (Trading), Southam Road, Banbury, Oxon. (Tel. Banbury 2821). Statistics Licences—Ministry of Supply, M.4 (Statistics), Southam Road, Banbury, Oxon. (Tel. Banbury 2821). Matters relating to production—Ministry of Supply, M.4 (Production), Shell Mex House, Strand, W.C.2 (Tel. Gerrard 6933).

DUNLOP RESEARCH GRANT

The Dunlop Rubber Co. is contributing £350 per annum for seven years to the Department of Colloid Science at Cambridge University for research work on molecular structure. For the past two years the Department has been carrying out research work for Dunlop on the structure of natural and synthetic rubber molecules, and the changes occurring in vulcanisation. The research will continue under the direction of Dr. G. B. B. M. Sutherland, a pioneer and world authority on the use of the infra-red spectroscope. The work under the new scheme will probably also include ultra-violet and ultra short-wave radio technique.

Austrian Chemical Industry

Dependence upon Imports

A SURVEY of the industrial chemical industry in Austria reveals considerable shortages and shows that for some time the Austrians will have to rely to a large extent upon imports, according to the Directorate of Information Services, Control Office for Germany and Austria. This is in direct contrast to the situation which existed before the Anschluss, when most of the chemicals required were produced within the country.

When the Nazis took over they closed many factories in order to boost their own products from Germany. In addition, much damage was sustained by plants and factories. The result was that after the liberation the Austrian chemical industry was faced with the task of starting again almost from scratch, and is now making great efforts to reduce dependence upon other countries.

Sulphuric Acid Shortage

One of the greatest requirements is sulphuric acid, of which Austria requires from 40,000 to 50,000 tons a year. The greatest amount formerly came from the Moosbierbaum works in Lower Austria. Since these have been dismantled, and the factory at Deutsch Wagram burnt out, the only source now is the Liesing factory, which produces about 7500 tons of sulphuric acid annually, thus leaving a great deficiency to be made up from other countries.

The iron and steel industries, artificial silk, and ersatz wool industries all need sulphuric acid for their work. Production of nitric acid, essential to agriculture, has been at a standstill, but it is hoped that the nitrogen works at Linz will soon be in production again. Soap and washing powders are extremely scarce owing to lack of the raw materials. Carbide is another essential commodity which is scarce; it is produced by only one factory, in the Tyrol. Compressed oxygen for use in welding is, of course, essential to all works of reconstruction, but cannot be obtained in anything like adequate quantities. There is no production of oxygen or salicylic acid.

Combined Chemical Industries, whose factories are at Floridsdorf, Vienna, state that they are beginning to make black and white enamels under new patents, but that raw materials are extremely scarce. They also state that they have acquired numbers of unspecified patents. They will be able to begin manufacture of bakelite again, but it will be impossible for them to make saccharin for some time.

Some Recent Improvements

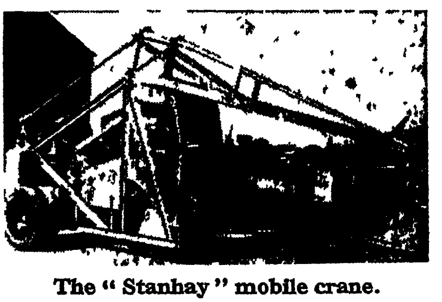
In contrast with the general situation, considerable increases in the production of chemicals are reported from the province of Carinthia, which comes within the British zone. Hydrochloric acid and carbide were the only chemicals showing decreases in last month's production figures, but there were several new products.

Last month's production included 72 tons of hydrochloric acid (31 per cent. decrease), 28 gallons of amyl alcohol (a new product), 50 tons of carbide (2 per cent. decrease), 48 tons of barium sulphide (against none in May), 2 tons of barium sulphate (40 per cent. increase), 4 tons of sodium hypochlorite (none in May), 3 tons of calcium molybdate (none in May), 27 tons of sodium sulphide (none in May), and a quarter-ton of magnesium carbonate (new product).

New Mobile Crane

Simple and Convenient in Operation

A VALUABLE adjuct in the problem of speeding up the handling and moving of goods within the confines of factories and works is the "Stanhay," the first air-operated mobile crane to be produced. It can be used either inside or outside a factory, and its versatility gives it a special claim to the attention of the chemical industry, where buildings of various shapes and sizes are the rule. The basic principle



The "Stanhay" mobile crane.

of this crane, which is fully mobile and self-propelled, is the conversion of compressed air into mechanical energy. The maximum height of the jib hook of the 1-ton model is 16 ft., and the maximum outreach 9 ft.; haulage capacity is 5 tons approximately. It is also worth recording here that the jib control lever is so responsive to the touch that a ton weight may be lowered to rest on the point of an upturned pencil without breaking the lead. Owing to its low total height the machine can lift, travel and turn in a radius of only 9 ft., and can hoist with load through doorways only 10 ft. high. The manufacturers are Stanhay, Ltd., Elwick Works, Ashford, Kent.

Scottish Seaweed Industry

Survey of a Year's Work

AT a Press conference held last week in Edinburgh, Dr. F. N. Woodward, B.Sc., Ph.D., F.R.I.C., technical director of the Scottish Seaweed Research Association, Ltd., presented a survey of investigations made by the Association during the past year, and threw out a few guarded hints about future possibilities.

Alginic acid is an extremely versatile raw material, and can be employed in almost as many ways as can cellulose, *e.g.*, in the manufacture of light-weight fabrics, transparent paper, textile size, and soluble surgical ligatures. It is also a possible ingredient of many foods, such as custard powder, soup, and ice cream, and can be used in the fining of beer. Dr. Woodward was careful to point out, however, that the one "selling point" of alginic acid fabrics was that they were non-inflammable; otherwise they could not compete with established fabrics. An interesting point, however, was that if woollen thread is combined with alginate yarn filament and then woven, the acid can be dissolved out, leaving a woollen fabric weighing only 1½ oz. per sq. yd., instead of the 5½ oz. per sq. yd. that is the lightest possible with untreated wool.

Possible Source of Mannitol

The polysaccharides known as mannans have been found to be present in Scottish wrack in greater quantity than anywhere else in the world, and Dr. Woodward suggested their possible exploitation as a source of mannitol. The principal raw materials hitherto have been the American ivory-nut and the carob bean; also spruce cellulose, which gives a mixture of mannose and dextrose. The naturally-occuring mannans are hydrolysed to give mannose, and that is reduced in its turn to produce mannitol, a constituent of certain explosives used during the war.

Obviously, the harvesting of the seaweed is of prime importance, and investigations have shown that the most promising sources of littoral weed are North Uist, in the Outer Hebrides, and Orkney. A survey of 3000 miles of coastline has revealed about 140,000 tons of littoral weed, allowing, perhaps, for a harvest every three years. Last May a survey of sub-littoral weed was started in Orkney; this type is much more difficult to harvest because it does not float when cut, and is not visible from the surface of the water, but a type of mechanical shovel has been evolved for the purpose.

The task of the Association, Dr. Woodward explained, is not only to find out where the weed is and how to harvest it economically, but to study variations in composition of the different kinds, and the effects of location, season and tides. Financially the work has been carried on on a fifty-fifty basis between the Government and the industry. The work of research is now to be financed 90 per cent. by the Treasury for a further period. Three factories are at present operating on the west coast and one in South Uist.

A large house at Inveresk is to become the headquarters of the Scottish Seaweed Research Association, with eleven acres of ground for further development. Copies of the Association's report are available from the hon. secretary, Mr. C. J. M. Cadzow, 28 Rutland Street, Edinburgh.

International Trade Fair

British Exhibits at Stockholm

A BRITISH visitor to the international trade fair which has just ended in Stockholm can scarcely avoid a sense of disappointment that Britain's great export drive has been so shyly reflected in the trade mirror held up to the Scandinavian people, writes our Staff Representative. True, St. Erik's Fair is relatively new—this was the fourth fair, and foreign participation was not possible until 1944—but whereas such British exhibits as there were this year were in the main linked with the stands of Scandinavian agents, quite a number of countries had their own pavilions and much larger and more representative displays. France, Belgium, Holland, Czechoslovakia and even Poland and Finland had exhibition halls of their own.

Interest in Technical Journals

If actual exhibits of U.K. manufacturers were few, evidence of eagerness to know what British manufacturers are making was provided at two stands where specialised British trade and technical journals were available, THE CHEMICAL AGE among them. These stands were crowded day after day, and the story of our own manufacturing progress and our services was conveyed by printed word and pictures to a great many people, some undoubtedly potential buyers of British goods.

There being little, therefore, to describe in connection with British manufactures, what of the products of industrialists and manufacturers elsewhere? The Scandinavian exhibits, naturally, were the most numerous. The steel and metallurgical side was strong, and there were good displays of machine tools and machinery generally, though unlike exhibits at our own British Industries Fair, few were shown in operation. By-products of the forestry and timber industry were prominent, plastics again revealed their extending uses in a striking way, and, as might be expected, the results of electrical development and progress are particularly well marked.

The exhibition was divided into several

sections, the main displays and the pavilions of the various participating countries being in the Royal Tennishall and adjoining buildings. About 100,000 visited the fair last year and 150,000 were expected this year. That " target " must have been well broken. Certainly on the final day (September 1), when the general public, as well as trade buyers, were admitted at 2.50 Kr. (about 3s. 6d.), the people were milling round in their thousands.

Zinc Plate Corrosion

New Phosphating Process

A PRE-TREATMENT of zinc plate, which, it is claimed, will revolutionise the whole field of phosphate coatings, has been described by a research chemist of Westinghouse Electric & Manufacturing Co., to the Elecrochemical Society.

The process, which is now being used in improving the corrosion resistance of zinc plate, was a more or less accidental discovery. Westinghouse began a research project to improve the corrosion resistance of painted metal plate. The focal point of the investigation was to seek a chemical predip which would confer upon the metal sheet the same superior acceptance of phosphate treatments (bonderising is one example) as mechanically polished samples. For some reason a highly-polished plate, will, after phosphating, make a firmer paint bond, and hence have better corrosion resistance than unpolished specimens. To the Westinghouse Co., in need of superior fittings for their electrical instruments, mechanical polishing of the many varied and intricate shapes was a physical impossibility; thus arose the emphasis and necessity for a pretreatment, such as a chemical dip, which would penetrate and evenly affect every square inch of the metal fixture.

After many months of fruitless search, the research chemist, in the course of the investigation, dipped zinc plate into disodium phosphate, gave it the usual commercial phosphate treatment, and after the salt spray and steam chest tests were made, the disodium phosphate pre-treatment was far superior to anything else. More extensive and elaborate experiments on disodium phosphate failed to duplicate, in any way, this one success. More tests showed that only one disodium phosphate in the whole laboratory would give the superior result and that came from the same bottle that gave the first success. Chemical analysis failed to show anything unusual, but suspecting a trace element, a spectroscopic analysis was made and a faint suggestion of titanium was found. Additions of this element, in various forms, still failed to bring about the wanted results from other disodium phosphates.

Success came, finally, from two directions, when a method to make the titanium impure salt was found. The exact reason why titanium should give such protective action still eludes research, though it is almost certain to be a colloidal phenomenon.

At present the concentration of titanium in the salt is 1/1000 per cent., and only a 1 per cent. solution of this disodium is used as a pre-dip. In production, the metal pieces, on a chain conveyor, pass through the pre-dip in 10 seconds. From there they go directly to the usual commercial phosphating bath, after which comes the spray painting or lacquering. Samples so treated will withstand 200 hours of salt spray or steam chest without any corrosion; conventional methods show the unwanted zinc " flowers," sign of failure, in 48 to 72 hours, which is unacceptable by modern standards.

Swiss Chemical Research

The Robert Gnehm Foundation

FURTHER proof of the interest and active support given in Switzerland to chemical research is provided by the report that Dr. Maria Gnehm has left one million francs to the famous Federal Technical Institute at Zürich, to be used for the encouragement and support of teaching and research in the field of chemistry.

The president of the trustees of the new foundation, which is to be known as the Robert Gnehm Foundation after the father of the testatrix, a former president of the Swiss School Council, is Dr. Arthur Stoll, vice-president of the Sandoz A.G. Part of the legacy will be used to enable lecturers from abroad to participate in the Federal Technical Institute's work. The series of Robert Gnehm Lectures was inaugurated on September 2, by a lecture given by Sir Robert Robinson, P.R.S.

Although well-known foreign lecturers have visited Zürich and other famous centres of chemical teaching in the past, this is the first instance of financial provision being made for this purpose. It is hoped this will go a long way towards re-establishing true international relations in this important branch of science.

ALUMINIUM PRICE INCREASE

The price of virgin aluminium in ingot or notch bar form was increased on Monday from £67 to £72 15s. a long ton, delivered into consumers' works. The new price applies to metal of a purity of 99 per cent. to 99.5 per cent. inclusive, with premiums for higher purities. The Ministry of Supply states that the increase in price is consequent upon the cost of metal under the Ministry's Canadian contract having risen on account of the change in the rate of exchange.

Bauxite in Australia

Survey of Likely Sources

PRODUCTION of sufficient aluminium metal to meet the full annual requirements of the Australian market is envisaged by the Australian Aluminium Production Commission, according to *Chemical Engineering and Mining Review*. An output of 10,000 tons of ingot would require the establishment of an alumina plant or plants to treat 60,000 tons of bauxite a year. The alumina will be reduced to metallic aluminium at a plant to be established in Tasmania, the site for which has not yet been finally chosen. Location of the alumina plant will depend on the results of a Commonwealth-wide survey now being carried out by the Commission.

An officer of the Commission returned recently from overseas with full information regarding the production of aluminium from bauxite, and experimental work on the treatment of Australian bauxite will be carried out at a laboratory to be established at the Derwent Park munitions factory, near Hobart.

Considerable quantities of bauxite are known to exist in Australia. Deposits in New South Wales, although extensive, are low-grade, containing 30-40 per cent. Al_2O_3. In Victoria the Mirboo district of Gipps land has a number of deposits which aggregate more than 750,000 tons containing 51 per cent. Al_2O_3, 7 per cent. Fe_2O_3 and 10 per cent. SiO_2. In Tasmania, deposits of bauxite were discovered at the Ouse in 1941, and testing with shafts and boreholes by the Tasmanian Department of Mines has proved 500,000 tons with 40 per cent. Al_2O_3 and 5 per cent. SiO_2. The Ouse deposits are ferruginous in nature.

Tasmanian Investigation

The Aluminium Production Commission is proceeding with a complete survey of all these likely sources of bauxite, and further work is now in progress in Tasmania Testing by bores and shafts of an area at St. Leonards, near Launceston, has given encouraging results. Other deposits in Tasmania to be tested are at Campbelltown, Swansea and Myalla, west of Wynyard. Test work in Tasmania is being carried out in collaboration with Dr. H. G. Raggatt, director of the Commonwealth Mineral Resources Survey, and the Tasmanian Department of Mines.

Deposits of bauxite occurring in Victoria, Queensland, New South Wales and Western Australia are to be investigated by the Commission in collaboration with the Minerals Resources Survey and local Departments of Mines.

The Aluminium Industry Act passed by the Commonwealth Government in 1944 provides for the use of Tasmanian hydro-electric power in the manufacture of ingot aluminium under joint Commonwealth and State control. Under the Commonwealth-State agreement, ratified by the Tasmanian parliament last year, the State is committed to provide half the capital of £3,000,000 needed for the establishment of the industry. The other £1,500,000 will be subscribed by the Commonwealth Government.

Australian Patents

Revolutionary Innovation

A BILL to amend the Patents Act, 1903-1935, has been passed in Australia and will soon become law. The most important innovation is contained in Section 38A, which provides for laying open all complete specifications to public inspection immediately after filing. Complete specifications already on file will be laid open to public inspection forthwith.

This new bill goes far beyond Section 91 (3) of the British Patents and Designs Acts, 1907-1946, according to which patent specifications filed under International Convention are laid open to public inspection 18 months after the earliest convention date claimed. Efforts are being made by professional institutions to obtain a regulation deferring the publication of complete specifications at least three months after the filing date, but it is not at all certain whether they will meet with any success.

As matters stand, prospective applicants for Australian patents will have to consider carefully whether premature publication of their complete specifications does or does not affect their interests in other countries. At present there are emergency laws and regulations in most countries, extending the period available for claiming priority, but these extensions will end sooner or later, say within 1947 or 1948, and then any publication of a complete specification in Australia will prevent the invention from being validly patented in many of those countries where a corresponding application was not made during the ordinary convention period.

If the somewhat revolutionary example of the new Australian bill were followed in other countries, the whole foundations of International Patent Law and Practice might be overturned with effects on manufacture and commerce which can be hardly foreseen now. In any case, it seems deplorable that a step which affects not only the internal affairs of the country passing that legislation was taken apparently without consultation with other countries, and against the advice of the professional institutions which had the necessary knowledge of, and experience in, international patent matters.

Personal Notes

SIR EDWARD J. GEORGE has resigned his directorships of the Consett Iron Co., Ltd., and Consett Spanish Ore Co., Ltd.

MR. C. A. F. HASTILOW has been re-elected president of the Paint Materials Association, and MR. S. W. GREIG and MR. C. A. CARTER will continue as vice-presidents.

DR. MAURICE STACEY, now reader in biological chemistry, has been appointed to the newly-established second chair in the Department of Chemistry at Birmingham University.

SIR ALEXANDER FLEMING and SIR HOWARD FLOREY have been awarded the Society of Apothecaries' Gold Medal in Therapeutics for 1946 in recognition of their work on penicillin.

MR. L. C. MONTAGUE, A.C.I.S., who has been appointed a joint managing director of Johnson, Matthey & Co., Ltd., has been associated with the company for 27 years; he has been its secretary for the past 12 years.

MR. J. D. PATTERSON, who was chief chemist and development manager of the Goodyear Tyre & Rubber Co. (Great Britain), from 1926 until 1937, has been appointed assistant manager of the chemical products division of the Goodyear Co., at Akron.

MR. A. HUTCHISON has retired from the chairmanship of Ernest Scott & Co., Ltd., and George Scott & Son (London), Ltd.; and MR. W. LINDSAY BURNS has been appointed chairman and managing director. New appointments to the board are: MR. LINDSAY BURNS, Jnr., MR. I. M. O. HUTCHISON, and MR. H. D. MACMURRAY, B.Sc., A.R.I.C., A.M.I.Chem.E.

MR. JULIAN L. BAKER, F.C.G.I., F.R.I.C., who is editor of the *Journal of the Institute of Brewing*, is retiring from his position as chemist to Watney, Combe, Reid & Co., Ltd., after 46 years' service, and will be succeeded in that capacity by DR. L. R. BISHOP, M.A., Ph.D., F.R.I.C., of the research department of the Institute of Brewing, Birmingham University.

Obituary

MR. JOHN ABBOTT, secretary and director of the United Drug Co., Ltd., Nottingham, has died at the age of 57.

A link with the foundation of the oldest of our research stations has been broken by the death of MRS. CAROLINE CREYKE, daughter of Sir John Bennet Lawes, one of the founders of Rothamsted. Mrs. Creyke, who was 101, died in London on September 8; the funeral took place at Harpenden parish church on Thursday.

MR. OLIVER WILKINS, who was chairman of the Paints Division of I.C.I. during the war, died at his home at Derby recently, aged 64. Mr. Wilkins was only 21 when he founded the Derby Chemical Co., in 1903, to manufacture paints. Four years later, the firm became Oliver Wilkins & Co., Ltd., and started the manufacture of pigment colours, which Mr. Wilkins rapidly developed. In 1928, when the firm became part of I.C.I., Mr. Wilkins joined the board of the Dyestuffs Division. Later he became largely responsible for the control of another Derby firm, Leech Neal & Co., Ltd. Mr. Wilkins retired for reasons of health at the end of the war.

Record Steel Output

Effect of More Coal in British Zone

STEEL production in the British zone of Germany in July was the highest reached in any month since the occupation began. This improvement, which was due to an increased allocation of coal and coke to the industry for the third quarter of the year, would have been still greater but for the continued serious shortage of labour.

The output of rolled products was 181,200 tons, an increase of 19,347 tons over the June figure, which was itself a record. The ingot steel output was 210,321 tons, and exceeded by 24,521 tons the previous highest level reached in March. The production of pig iron in July was substantially higher than in june and only slightly below the March record.

ALUMINIUM IN FORMOSA

According to reports recently received in this country, the aluminium industry in Taiwan (Formosa), which suffered serious damage during the war, is expected to be fully restored by 1948. Three experts from the United States are visiting the island to investigate conditions and later to collaborate in getting the industry back on its feet.

The industry is centred in Kaohsiung and Hualien, and after the Japanese surrender the factories were taken over by the Chinese Government. At present, the plants are under the management of the Taiwan Aluminium Co., which has recently been set up by the National Resources Commission. It is estimated that about $12,000,000 will be needed to repair the two plants, and it is hoped to secure 40 per cent. of this amount from the United States. The Kaohsiung plant, which was established by the Japanese in 1936, with an annual production of 12,000 tons, was closed in March, 1945. The second plant, which produced about 8000 tons a year, was closed in 1944.

General News—From Week to Week

Dutiable articles may now be sent from the U.K. to Eire by letter post.

A restricted air mail service to Germany is now available, and correspondence will be subject to censorship in Germany.

The vital need for increased use of fertilisers in Scotland is indicated in a survey carried out by the Department of Agriculture in Scotland.

A useful bibliography of insecticide materials of vegetable origin is included in the current issue of the *Bulletin of the Imperial Institute*.

Women workers in a new nylon stocking factory at Kimberley, near Nottingham, have been supplied for several months past with a special hand cream so that their hands may be smooth for handling the stockings

An important new industry has been established at Galashiels by Sanderma Fur Co., Ltd., who will exploit American methods of converting wool into synthetic fur, by means of chemical reaction methods, using materials developed in the plastics industry there.

Recently registered as a private company incorporated outside Great Britain, is American British Technology, Inc., with a nominal capital of 200 shares without par value, formed to investigate current developments in technical process, industrial designing, etc.

A conference of countries producing or consuming tin will be opened in London on October 8. The International Tin Committee, originally founded in 1931, was last renewed on January 1, 1941, and will cease to exist unless the conference decides to renew it at the end of the year.

Readers are reminded that application forms (returnable by December 2) and particulars of the Associate-Membership examination for 1947 of the Institution of Chemical Engineers may now be obtained from the Hon. Registrar of the Institution at 56 Victoria Street, London, S.W.1.

To ensure compliance with the Control of Tin (No. 3) Order, 1941, certain formalities are necessary in connection with tin metal which has to be transhipped in this country in bond when en route through the U.K. for destinations abroad. Importers should, where necessary, apply for further information either to the Directorate of Non-Ferrous Metals, 20 Albert Street, Rugby, or to the Secretary of the London Metal Exchange, Whittington Avenue, London, E.C.3.

Foreign News

Penicillin is to be produced in the Institute for Microbiology at Jena in the Soviet Russian zone of occupation.

Thirty blast furnaces, with a total capacity of 9,000,000 tons a year, are to be erected in the Soviet Ukraine.

Exports of gum arabic from the Sudan amounted to 15,200 tons for the first five months of the current year, as compared with 4900 tons for the same period last year.

The Australian Government has decided to continue control of the production and distribution of mica until the end of the year.

An extensive deposit of barytes, recently discovered in Swaziland, is now being worked by a new company, Swaziland Barytes, Ltd.

News has just come from America that the Boykin Bill received the approval of Congress on August 8, 1946, and has now been enacted as Public Law 690—79th Congress, H.R. 5223.

The South Australian Government has decided to make a three-year survey of 150 square miles of rough country in the Flinders Ranges to discover the value and extent of the State's uranium deposits.

The Behring works at Marburg, Germany's leading producer of sera and vaccines, is operating at the normal peace-time capacity, its products being supplied to all zones of occupation.

Mexican production of non-ferrous metals aggregated 9,137,497 tons for the period 1940-45, valued at 4,125,980,940 pesos. The peak production was reached in 1943 with 1,725,103 tons, worth 825,632,918 pesos.

Important deposits of bentonite are being investigated by the New Zealand Geological Survey Department. The deposits are situated mainly on the east coast, around Poverty Bay, and are now yielding hundreds of tons of the mineral.

The Swedish iron supply position for the home market is more strained than ever, stated the Minister of Supply, Hr. Gjoeres, in an interview with *Svenska Morgonbladet* The shortage makes itself especially felt in the manufacture of agricultural machinery.

One of Newfoundland's abandoned lead mines, the La Manche mine, may soon be back in production after about 56 years' idleness. The American Smelting and Refining Company has concluded negotiations with the owners to take over and exploit the property.

Iron and steel, roller bearings, and chemical products are to be shipped to Hungary, by Sweden, and cryolite and pharmaceutical goods by Denmark, under the terms of recently concluded trade agreements. In return, Hungary will send agricultural products and bauxite.

Tin mining operations at Derby, Tasmania, once the largest alluvial tin mine in the Commonwealth, have come to a standstill, but conferences are in progress between the State Government and the company, the Briseis Consolidated N.L., to prevent the abandonment of operations.

Prospecting for oil in French Equatorial Africa has been resumed after war-time suspension, according to the French technical press, and it is reported that in the Gaboon oil-bearing strata have been reached in the neighbourhood of Lake Azingo, at no great depth from the surface of the ground.

Dyes in a wide variety of new shades have been produced by Juliette Gaultier de la Verendrye from the world-famous Holland black tulips which were sent to Canada as a sign of appreciation by the Dutch for the role played by Canadian troops in liberating their country.

The Italian heavy industrial enterprise, Società Nazionale, Cogne, Turin, a State-owned unit, which exploits iron-ore mines at Cogne and anthracite mines at La Thuile, and operates steel works at Aosta, is to increase its capital from 400,000,000 lire to one milliard lire.

At a recently held extraordinary general meeting of the Montecatini Company, the board's scheme for the reorganisation of the group's finances (*see* THE CHEMICAL AGE, August 10, p. 170) was unanimously accepted. It is hoped that this measure will substantially assist in the group's rehabilitation and reconstruction without jeopardising its financial independence.

Several new records were made in the U.S.A. domestic phosphate rock industry in 1945, according to reports submitted by operators to the Bureau of Mines, U.S. Department of the Interior. Total mined production reached a new high level at 5,399,739 long tons, and the quantities mined in Florida (3,814,935 tons) and the Western States (323,955 tons) were also new records.

A number of German metallurgical enterprises have recently resumed operations, including the parent company of the Wieland group, the Wieland works at Ulm, and its branch at Vöhringen, Bavaria. The Deutsche Edelstahlwerke A.G., Krefeld, are working with a labour force of about 500 men, and production has been resumed some time ago in the aluminium works at Nuremberg. The Luitpoldhütte furnace at Amberg, in Bavaria, has also been restarted.

The first retort of a battery of six, for the retorting of torbanite shale (from which petrol is produced), was recently tested by the deputy chairman and managing director of the Anglo-Transvaal Consolidated Investment Co., Ltd. He said that at Ermelo, South Africa had the only successful oil-from-shale industry in the world.

A trade and payments agreement signed recently between Switzerland and Austria, provides for the export of Swiss industrial chemicals (mainly sulphuric acid, dyestuffs and pharmaceutical products) against Austrian steel, hardening metals, china-clay, magnesite, talcum, refractory materials, ceramics and glassware.

A report advocating the formation of a national standards body for India has been issued by a committee of the Indian Institution of Engineers. It is recommended that the work be placed under the control of a General Council consisting of representatives of industrial organisations, Government departments, and Indian States.

Zinc coating of bridges, pipes and other iron and steel surfaces, is being tested in the United States as an alternative to lead paint. The zinc is applied in powder form, mixed with an inflammable gas, from a special spray-gun, at a temperature of 800° F. The chief advantages of the method are said to be long life of the coating, which lasts about 12 years, and its lightness. No details regarding the cost are as yet available.

The latest addition to the list of Swedish iron works planning an expansion of output is Hellefors Bruks A/B. According to *Morgon-Tidningen*, the company intends to construct new plants at a total cost of 10,000,000 kronor. Total investments planned by the Swedish iron and steel industry amount to 200,000,000 kronor, of which one-half is to be invested in the Government-owned Norrbottens Jaernverk.

The Czechoslovak chemical industry reports an increased output as a result of the gradual improvement in the raw material supply position. The need to find an alternative source of certain supplies after UNRRA has ceased to operate may, however, cause new difficulties. The glass industry's position is slowly but steadily improving, although the world shortage of potash is making itself felt.

Forthcoming Events

September 16. Institution of Works and Factory Managers (S.E. London Branch). Bonnington Hotel, London, W.C.2, 6.30 p.m. Mr. A. H. Buckle, M.I.Ec.E.: "Psychological Instability—Government and Working Classes."

September 16-19. Association of Tar Distillers. Programme of meetings at Queen's Hotel, Leeds, 1: September 16, 6 p.m.,

National Pitch Committee; September 17, 10 a.m., National Creosote Executive Committee, 2.15 p.m., A.T.D. Executive Committee; September 18, 9.30 a.m., A.T.D. Naphthalene Refiners, 10.30 a.m., A.T.D. general meeting, 2.15 p.m. National Creosote Committee, 4 p.m., B.R.T.A. Managing Council; September 19, 9.30 a.m., Pitch Marketing Company and Pitch Supply Association.

September 17. Society of Chemical Industry (Manchester Section). Engineers' Club, 17 Albert Square, Manchester, 6.30 p.m. Mr. W. L. Badger: "Chemical Engineering in the United States."

September 19. Oil and Colour Chemists' Association (Manchester Section). Visit to works of Monsanto Chemicals, Ltd., Ruabon. Motor coach leaves Lower Mosley Street, bus station, Manchester, 9.30 a.m.

September 21. Royal Institute of Chemistry (London and S.E. Counties Section). Oak Restaurant, 18 Kensington High Street, W.8. 7-11 p.m. Social dance in aid of benevolent fund.

September 23-28. Welsh Industries Fair. Drill Hall, Cardiff, 11 a.m.-6 p.m.

September 25 and 26. British Ceramic Society (Refractory Materials Section). Royal Sanitary Institute, 90 Buckingham Palace Road, London, S.W.1. Autumn meetings. Sept. 25: 10.15 a.m., business, followed by joint discussion with Building Materials Section; 12.30, lunch; 2.30 p.m., papers. Sept. 26: 10 a.m., papers.

September 25 and 26. British Ceramic Society (Building Materials Section). Royal Sanitary Institute, 90 Buckingham Palace Road, London, S.W.1. Autumn meetings. Sept. 25: 10.15 a.m., business, followed by joint discussion with Refractory Materials Section; 12.30, lunch; 2.30 p.m., discussion; 4 p.m., paper. Sept. 26: visit to Stewartby works of London Brick Co., Ltd., 9.25 a.m. train from St. Pancras.

September 26-27. Council of Industrial Design and Federation of British Industries. Central Hall, Westminster, London, 10 a.m.

September 26. Royal Statistical Society. (Sheffield Group). Royal Victoria Station, Hotel, Sheffield, 6.30 p.m. Mr. A. W. Swan: "What Statistics Can Do in Industry that Other Methods Cannot Do."

September 26. Imperial Institute. Cinema Hall, Imperial Institute, South Kensington, London, S.W.7, 3 p.m. Mr. S. Bracewell: "The Geology and Mineral Resources of British Guiana."

September 26. Oil and Colour Chemists' Association (London Section). Royal Society of Tropical Medicine and Hygiene, 26 Portland Place, London, W.1, 6.30 p.m. Mr. G. T. Bray: "Drying Oils and Oil Seeds in the British Empire."

New Companies Registered

McConnel Bomford, Ltd. (418,204).—Private company. Capital £5000 in £1 shares. To acquire and turn to account scientific, chemical, metallurgical and other inventions. Directors: F. W. McConnel; D. R. Bomford. Registered office: Granite House, London, E.C.4.

L.A.C. Manufacturing Company, Ltd. (418,382).—Private company. Capital £1000 in £1 shares. Manufacturers of and dealers in chemicals, drugs, disinfectants, fertilisers, etc. Directors: H. A. Cook; Mrs. Isabel Cook. Registered office: St. Bride's House, 11 Salisbury Square, E.C.4.

Akos Chemicals, Ltd. (418,690).—Private company. Capital £100 in £1 shares. Manufacturers of and dealers in soap substitutes, soapless detergents, disinfectants, etc. Subscribers: W. E. D. Smedley; M. E. Crichton. Registered office: 36 Southampton Street, London, W.1.

Company News

I.C.I. (Export) Ltd., 57 King Street, Manchester, 2, announces that its name has been changed to Imperial Chemical Industries (Export), Ltd.

A final dividend of 10 per cent., making 20 per cent. for the year, which is the same as for the previous year, is being paid by **Titanine, Ltd.** Profit for the year ended March 31 was £20,862, which compares with £26,559 for the previous twelve months.

The United Indigo and Chemical Co., Ltd., reports that profit for the year to June 30 last was £17,839, as compared with £18,569 for the previous year. The ordinary dividend of 10 per cent. is an increase of 2½ per cent over that paid for the previous year.

As we were going to press, an extraordinary meeting of **Griffiths Hughes Proprietaries, Ltd.,** was being held to consider a proposal to convert the whole of the issued 5½ per cent. preference and ordinary shares into 5½ per cent. preference stock and ordinary stock respectively. If the scheme is approved, the stock of each class will be transferable in amounts and multiples of £1.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Receivership

FREERS CHEMICAL WORKS, LTD., 369, Richmond Road, E. Twickenham. (R., 14/9/46.) B. E. Pearcy, chartered accountant, 199, Piccadilly, W., was appointed receiver on July 4, 1946, under powers contained in debenture dated May 31, 1946.

Chemical and Allied Stocks and Shares

STOCK markets were dominated by the Wall Street slump and have moved closely with the day-to-day advices from that centre. There was a general precautionary marking down of prices in most sections, leading industrials being affected, but the lower prices brought out little stock, and the tendency generally became steadier, although buyers continued to display caution, awaiting international news. Strength of British Funds was impressive (fractional gains were again in evidence in this section) and later tended to have a steadying influence on markets generally.

Imperial Chemical have receded to 42s. 6d., at which there is a not unattractive yield, and it is generally assumed there are good prospects of the dividend remaining on an 8 per cent. basis. Courtaulds came back to 53s. 3d., British Celanese to 33s. 3d., and Dunlop Rubber to 71s., while Borax Consolidated were 46s. 9d., and shares of various other companies with business interests in the U.S. moved back, although selling was not heavy. United Molasses were 52s. The units of the Distillers Co. came back sharply to 311s. 3d., British Plaster Board receded to 32s. 6d. and Associated Cement to 65s. 9d.

Despite the good impression created by the full results and the reference to new capital requirements, which it is being assumed will involve a share offer to shareholders, De La Rue have receded to £12. Turner & Newall at 86s. reflected the market trend, but there was a better tendency in paint shares, the current view being that they had recently been marked down unduly following the big increase made in the price of linseed oil. Pinchin Johnson rallied to 43s. 3d., Goodlass Wall to 28s. 9d., and Lewis Berger were higher at 6 21/32, the latter on higher dividend anticipations. British Aluminium strengthened on the increased metal price, but later came back to 43s. 3d. Amalgamated Metal, after improving to 20s. 6d., receded to 20s. 3d., and Imperial Smelting were 19s. 6d.

Iron and steels continued to be steadied by the belief that nationalisation of the industry is postponed until at least 1948; while yield considerations and hopes of increases in forthcoming dividends again drew attention to colliery shares. Staveley were 52s., Colvilles 25s. 6d., Powell Duffryn 24s., Ruston & Hornsby 64s. 3d., Thomas & Baldwins 11s. 9d., and United Steel 26s.; but, on the other hand, Dorman Long eased to 26s. 9d., Babcock & Wilcox to 64s. 9d., and Tube Investments to 6 1/16. Gas Light & Coke were 21s. 4½d.

In other directions, B. Laporte remained at 100s., Fisons changed hands around 61s. 9d., British Drug Houses were 53s. and Griffiths Hughes 62s., while Aspro, awaiting the dividend announcement, showed activity around 39s. 6d. Beechams deferred were down to 26s., Sangers 35s. and Boots Drug 62s. 6d. xd. Triplex Glass fluctuated; after falling to 40s. there was a rally to 42s., and a subsequent reaction to 41s. 6d. United Glass Bottle, reflecting the market trend, changed hands down to 88s. British Industrial Plastics were 8s. 1½d., and Erinoid active around 16s., the latter on market hopes of a higher dividend. British Xylonite came back to £7. British Lead Mills shares changed hands around 11s. 9d. Oils showed further declines owing to market conditions, Shell coming back to 89s. 4½d., while Anglo-Iranian were 95s. 7½d., Ultramar 67s. 6d., Canadian Eagle 30s. 9d., and Lobitos 65s. 9d.

British Chemical Prices

Market Reports

CONDITIONS in most sections of the London general chemicals market remain steady, with the movement of supplies against contracts continuing satisfactorily. New business, both for home and export account, has again been on a good scale, with spot transactions restricted by the limited supply position. A steady demand persists for the general run of the potash and soda products and interest has been fully maintained in other sections of the market. Prices continue firm at recent levels. There has been little change in the coal tar products market, there being a ready outlet for available supplies.

MANCHESTER.—Chemical traders on the Manchester market during the past week have reported a steady flow of replacement buying on a wide range of textile chemicals for home users, and other leading industrial users are mostly taking good supplies against contracts. New export inquiries have also been a feature of the week's operations, and these also, in addition to the alkalis, have covered a wide field of heavy products. The undertone of the market is firm in all directions. Sulphate of ammonia is in fair request, including fresh buying for export, and new business has also been reported in slag and superphosphates. Good contract deliveries of most of the leading light and heavy tar products are reported.

GLASGOW.—No great changes can be recorded in the Scottish heavy chemical market during the past week. Business is brisk and inquiries and orders are being regularly received for all classes of heavy chemicals and raw materials, with, as usual, demand far exceeding available supplies. Export inquiries continue unabated and orders are well up to standard, prices also tending to increase.

Price Changes

Lead Nitrate.—MANCHESTER: £68 per ton d/d in casks.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Chemical reaction processes. — Anglo-Iranian Oil Co., Ltd., and R. O. Judd. 24084.

Treatment of tall oils.—Armour & Co. 24624.

Ion-exchange reactions.—A.S.P. Chemical Co., Ltd., C. L. Walsh, and B. A. Adams. 24183.

Cation exchange materials. — A.S.P. Chemical Co., Ltd., B. A. Adams, H. R. Bott, and R. C. Barker. 24182.

Treatment of textiles.—W. Baird, T. Barr, A. Lowe, and I.C.I., Ltd. 24127.

Treatment of textiles.—W. Baird, T. Barr, A. Lowe, J. Oliver, and I.C.I., Ltd. 24126.

Heterocyclic compounds. — Boots Pure Drug Co., Ltd., P. Oxley, and W. F. Short. 24045.

Aluminium alloys.—R. M. Bradbury. 23913.

Tetrahydropyran.—J. G. M. Bremner, D. G. Jones, R R. Coats, and I.C.I., Ltd. 24130.

Magnesium hydroxide.—British Periclase Co., Ltd., W. C. Gilpin, and N. Heasman. 24668.

Electro-deposition of metals. — British Piston Ring Co., Ltd., T. R. Twigger, Monochrome, Ltd., and H. C. Hall. 23936.

Electro-chemical processes.—J. G. H. Budd. 24170.

Ethers.—Ciba, Ltd. 23986-7.

Dyestuffs.—S. Coffey, K. Schofield, F. H. Slinger, W. W. Tatum, and I.C.I., Ltd. 24125.

Penicillin. — Commercial Solvents Corporation. 24608.

Treatment of starch.—Corn Products Refining Co. 24286.

Polymeric materials.—E. I. Du Pont de Nemours & Co. 24626.

Coating compositions.—E. I. Du Pont de Nemours & Co., S. Graves, and M. T. Gillies. 24454.

Polyhydroxy compounds.—E. I. Du Pont de Nemours & Co., W. F. Gresham, and R. E. Brooks. 24122.

Coating compositions.—E. I. Du Pont de Nemours & Co, J. W. Iliff, and M. T. Gillies. 24455.

Purification of water.—J. E. Edwards, and I.C.I., Ltd. 24128.

Synthetic resin adhesives.—R. L. J. Farina. 24295.

Inorganic compounds.—H. R. Frisch. 24604.

Pigment extraction.—General Biochemicals, Inc. 24146.

Alloys.—Handy & Harman. 24189.

Light polarising elements.—International Polaroid Corporation. 24620.

Dye images.—International Polaroid Corporation. 24621.

Iodine images.—International Polaroid Corporation. 24622.

Ferrous metal articles. — H. W. K. Jennings (Al-Fin Corporation). 24509.

Heat treatment of metal articles. — H. W. K. Jennings (Al-Fin Corporation). 24510.

Styrene.—L. E. Jones (Carbide & Carbon Chemicals Corporation). 24526.

Fertilisers.—T. D. Kelly. 24230.

Polyvinyl derivatives. — R. R. Lyne, A. W. S. Clark, and I.C.I., Ltd. 24449.

Electrodeposition of nickel.—Mond Nickel Co., Ltd. 24512.

Organic compounds.—N.V. Philips Gloeilampenfabrieken. 24614.

Complete Specifications Open to Public Inspection

Production of metanilamidodiazines and intermediates thereof.—American Cyanamid Co. Feb. 14, 1945. 1213/46.

Production of metanilamidodiazines.—American Cyanamid Co. Feb. 14, 1945. 1214/46.

Electro-thermo-chemical processes such as combustion, distillation, synthetic reactions, molecular or atomic dissociations and the like, particularly applicable to organic bodies.—M. E. A. Baule. May 11, 1942. 21512/46.

Waterproofing textile materials containing fibres of an organic derivative of cellulose.—British Celanese, Ltd. April 22, 1943. 7426/44.

Production of iron or steel alloys containing vanadium and silicon. — Climax Molybdenum Co. March 6, 1941. 5349/42.

Production of ferrous alloys containing cobalt and silicon.—Climax Molybdenum Co. March 6, 1941. 5350/42.

Production of ferrous alloys containing chromium and silicon.—Climax Molybdenum Co. March 6, 1941. 5351/42.

Production of ferrous alloys containing titanium and silicon.—Climax Molybdenum Co. March 6, 1941. 5352/42.

Production of iron or steel alloys containing tungsten and silicon. — Climax Molybdenum Co. March 6, 1941. 5353/42.

Chemical Processes.—E. I. Du Pont de Nemours & Co. Feb. 15, 1945. 4812/46.

Elastic fabrics. — E. I. Du Pont de Nemours & Co. Feb. 20, 1945. 5302/46.

Production of cured ethylene polymers and related materials.—E. I. Du Pont de Nemours & Co. Feb. 20, 1945. 5303/46.

Colouring fibres and the like from normally solid ethylene polymers.—E. I. Du Pont de Nemours & Co. Feb. 20, 1945. 5304/46.

Process for improving the properties of nylon fibres.—E. I. Du Pont de Nemours & Co. Feb. 20, 1945. 5305/46.

Dehydrohalogenated derivatives.—Glenn L. Martin Co. Feb. 15, 1945. 2487/46.

Laminated material and fuel containers comprising the same.—Imperial Chemical Industries, Ltd. Sept. 21, 1942. 6144/44.

Polymerisation of vinyl acetate.—Imperial Chemical Industries, Ltd. July 13, 1943. 13403/44.

Hydrolysed vinyl polymers. — Imperial Chemical Industries, Ltd. Feb. 16, 1945. 5002/46.

Synthetic resins and the preparation thereof.—International Polaroid Corporation. March 6, 1942. 4159/44.

Light polarising devices.—International Polaroid Corporation. Feb. 17, 1945. 25800/45.

Inhibiting the oxidation of copper or lead powder.—Metals Disintegrating Co., Inc. Feb. 15, 1945. 4317/46.

Recovery of metallic vanadium from mineral products. — H. F. C. C. De Montecchio. Dec. 22, 1944. 5185/46.

Processes of imparting hydrophobic properties to textile fibres.—Montclair Research Corporation. Feb. 16, 1945. 34514/45.

Dry starch preparations soluble in cold water.—N.V. W. A. Scholten's Chemische Fabrieken. Nov. 23, 1944. 21650/46.

Manufacture of foodstuffs and food preparations from leguminosae.—N.V. W. A. Scholten's Chemische Fabrieken. Jan. 22, 1943. 21927/46.

Packing made of plastic material chiefly for pharmaceutical tubes. — C. Nicolle. Feb. 19, 1945. 12828/46.

Preparation of penicillin.—Parke, Davis & Co. Nov. 23, 1942. 20638/43.

Manufacture of a thiophane derivative.—Roche Products, Ltd. Feb. 2, 1945. 3172/46.

Purification process for antibiotics.—Shell Development Co. Feb. 14, 1945. 34627/45.

Catalytic conversion of hydrocarbons.—Shell Development Co. Feb. 14, 1945. 34994/45.

Manufacture of phosphorus oxychloride.—Soc. Anon. des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny & Cirey. Aug. 16, 1944. 21863/46.

Manufacture of hard calcined alloys.—Soc. Le Carbone-Lorraine. July 4, 1941. 21610/46.

Manufacture of calcined alloys.—Soc. Le Carbone-Lorraine. June 20, 1941. 21611/46.

Preparation of acetylbutyrolactone.—U.S. Industrial Chemicals, Inc. Feb. 17, 1945. 33183/45.

Refining of steel.—E. F. J. Warnant. Feb. 14, 1945. (Cognate applications 4681-2/46.) 4680/46.

Complete Specifications Accepted

Ferrous alloys.—J. C. Arnold. (Coast Metals, Inc.) April 26, 1944. 579,479.

Production of cellulose.—S. C. Bate. Nov. 5, 1943. 579,669.

Production of sulphone amidines and salts thereof.—Boots Pure Drug Co., Ltd., W. F. Short, and A. Koebner. June 6, 1944. 579,613.

Chlorination of alcohol.—W. Bridge, J. Matchet, and I.C.I., Ltd. Dec. 20, 1943. 579,678.

Solidifying normally liquid hydrocarbons.—D. M. Clark. (Safety Fuel, Inc.) Feb. 8, 1944. 579,568.

Heterocyclic compounds.—F. H. S. Curd, C. G. Raison, F. L. Rose, and I.C.I., Ltd. Sept. 5, 1944. 579,502.

Manufacture of highly polymeric substances.—J. T. Dickson. (Cognate applications 13744/43 and 13826/44.) Aug. 23, 1943. 579,462.

Production of new dyes of the anthraquinone series.—E.I. Du Pont de Nemours & Co., M. A. Perkins, and D. X Klein. May 12, 1944. 579,519.

Manufacture of *n*-butyl vinyl ether.—W. J. R. Evans, and I.C.I., Ltd. Nov. 22, 1943. 579,675.

Polymerisation and interpolymerisation of ethylene.—J. S. A. Forsyth, and I.C.I., Ltd. Nov. 3, 1943. 579,666.

Polymerisation and interpolymerisation of ethylene.—J. S. A. Forsyth, and I.C.I., Ltd. Dec. 10, 1943. 579,676.

Protective covering for metal articles and method of applying.—Hercules Powder Co. Oct. 1, 1943. 579,556.

Catalytic dehydrogenation of hydrocarbons. — Houdry Process Corporation. March 5, 1943. 579,477.

Distillation of solid carbonaceous substances.—Low Temperature Carbonisation, Ltd., and J. Cartwright. Nov. 3, 1939. (Cognate applications 29,359/39 and 17,174/40.) 579,561.

Manufacture of pyridine carboxylic acids.—Merck & Co., Inc. May 11, 1943. 579,505.

Alloys containing manganese. — Mond Nickel Co., Ltd. (International Nickel Co., Inc.). July 31, 1940. 579,643.

Process for producing insoluble sodium metaphosphate.—Monsanto Chemical Co May 27, 1943. 579,518.

Manufacture of non-ferrous welding rods or electrodes.—E. C. Rollason, and Murex Welding Processes, Ltd. June 23, 1944. 579,635.

Preparation of diethylamide of *d*-lycergic acid.—Sandoz, Ltd. April 30, 1943. 579,484.

Production of artificial insolubilised wet-spun protein filaments.—R. H. K. Thomson, D. Traill, and I.C.I., Ltd. Sept. 6, 1944. 579,588.

Resistance welding apparatus.—N. A. Tucker, and Mallory Metallurgical Pro ducrts, Ltd. May 17, 1944. 579,527.

Refining of crude acrylonitrile.—American Cyanamid Co. Dec. 1, 1942. 579,787.

Production of biguanides. — American Cyanamid Co. March 5, 1943. 579,867.

Liquid fuel containers and adhesives therefor.—B. J. Balfe, and I.C.I., Ltd. Sept. 16, 1943. 579,768.

Oxidation or the removal of carbon monoxide.—J. H. De Boer, and J. Van Ormondt. Aug. 25, 1941. 579,809.

Process for the production of reactive substances containing argentic oxide. — J. H. De Boer, and J. Van Ormondt. Aug. 25, 1941. 578,817.

Apparatus used for generating and purifying oxygen.—H. L. Bolton, E. Q. Laws, and G. H. Thomas. July 23, 1942. 579,737.

Low temperature separation of compressed gaseous mixtures.—British Oxygen Co., Ltd., and R. C. Godfrey. Aug. 10, 1944. 579,712.

Curing of polymeric materials.—J. G. Cook, R. C. Seymour, and I.C.I., Ltd. Jan. 28, 1944. 579,857.

Manufacture of vinyl and ethylidene esters.—E. I. Du Pont de Nemours & Co. Sept. 24, 1943. 579,715.

Application of metal coatings on articles and surfaces of aluminium and its alloys.—E. I. Du Pont de Nemours & Co., and H. N. Gilbert. Nov. 1, 1943. 579,830.

Production of cyanogen.—E. I. Du Pont de Nemours & Co., B. S. Lacy, H. A. Bond, and W. S. Hinegardner. Dec. 17, 1943. 579,785.

Safety devices for apparatus for storing or employing liquefied combustible gases.—A. C. G. Egerton, and J. H. Burgoyne. March 8, 1940. 579,841.

Process for the production of coloured synthetic resin articles.—W. E. F. Gates, and I.C.I., Ltd. Dec. 20, 1943. 579,756.

Methods for the surface carburising of steel. — General Electric Co., Ltd., I. Jenkins, and S. V. Williams. Nov. 2, 1942. 579,742.

Detergent composition and its application in the removal of mineral oil from metal surfaces.—Imperial Chemical Industries, Ltd. March 5, 1943. 579,866.

Production of powdered polythene. — K. B. Jarrett, and I.C.I., Ltd. Sept. 17, 1943. 579,769.

Reclaiming of copper from metal plates. —H. W. K. Jennings (Crowell-Collier Publishing Co.). April 21, 1944. 579,753.

Manufacture of incendiary mixtures.—J. G. King, and C. M. Cawley. Sept. 16, 1942. 579,739.

Manufacture of incendiary pastes or gels. —J. G. King, C. M. Cawley, and J. H. G. Carlile. Sept. 16, 1942. 579,740.

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1421. September 21, 1946 Annual Subscription 21s. Overseas 26s.

Accountancy and Technology

THE accountant is a very necessary member of the staff of every large firm. To a small firm he is an essential visitor, a periodic comet who, having inspected us closely, retires into outer space and is no more seen. Accountancy, as an art, must be practised by every firm, for to ignore the monetary aspects of business is to court bankruptcy. The accountant, however, is like fire: a good servant but a bad master. The professional accountant would not agree to that statement. In his view he is the dominant personality in business transactions. It is through his skill, he believes, that costs are known and that the consuming enthusiasm of the technical men is kept within the bounds of sound finance.

There is a tendency in the business world to-day to promote the accountant to the highest positions, while leaving the technologist to hoe his less exalted row, keeping his nose well to the ground. There are many examples of great businesses in which the accountant is supreme, while the technical men are kept in their former places. We should be far from disputing the fact that high technical qualifications do not necessarily make for high administrative powers. Let the best man be promoted to the management and to the Board. But do not let us make the mistake of believing that because a man belongs to a profession that understands finance, he is necessarily a better manager than one who is primarily a technologist. The higher posts must be filled on the basis of personal ability, not according to the profession of the individual.

There is another, and possibly more general, aspect of this inter-relation between the professions. In a firm that is otherwise well-balanced, the management is less often technical in outlook and training, and in consequence, since all firms must operate for profit, the management tends to regard the accountant as the ultimate authority. The accountant is more likely to be called in when the engineer has had his say and has gone his way. It is the accountant who will submit the engineer's statement to what he deems to be the cold light of reason, and on his report the proposal is likely to be accepted or turned down. "Business men," especially those of the genus who live in one particular part of the country, pride themselves upon their hard-headedness. Each wants to know that his venture will "pay"; for this assurance he looks to the accountant.

Quite firmly we hold that this attitude is all

On Other Pages

wrong. In this we are sustained by Dr. Cohoe, this year's Messel Medallist. This is what he said in his Memorial Lecture: "The accountant is handicapped by his ignorance of possibilities. He can review a balance sheet with intelligence and ability, but he may forget that a balance sheet may be ancient history. . . . He is fearful in a fast-moving world of obsolescence, and instead of making a bold decision, retains uneconomic procedures." The limitations of the accountant are quite plain. An admirable and conscientious worker, he is inevitably found to fail in the direction of a business if his outlook is bounded by the methods of his art—or craft, whichever it be. Any attempt to run a business on the basis of last year's accounts is bound to fail for the same reason. It is, quite simply, because the balance-sheet is history, and is therefore static, whereas technology is dynamic. We cannot say with justification that because certain processes made a profit last year, and the year before, they will therefore make a profit next year. Others may have discovered and put into practice better plant and better methods which will enable them to reduce their costs so that the established product which did so well last year will be undercut and rendered unsaleable. The technologist is the man who knows these things. It is from his knowledge that future improvements can be forecast and put into effect. "The technologist," says Dr. Cohoe, "constantly has his eyes on the future. He is seldom satisfied with the *status quo* and he cannot abide obsolete equipment or methods."

Overmuch reliance upon accountancy as the guiding principle in business leads, as Dr. Cohoe has pointed out, to the depth of absurdity when "through the employment of obsolete methods and equipment, production can be maintained and dividends paid only if subsidies in some form be received. When capital allows itself to sink into this position it opens the door by which the proponents of nationalisation may find easy entrance." Tariffs are one form of subsidy. We should not like to suggest that tariffs are never necessary. There may be special advantages which one nation has in regard to accessibility of raw materials, cheap power, or other artificial advantage (including cheap labour), that makes it necessary for tariffs to be imposed to maintain sufficient home trade to keep industry alive. Generally speaking, however, industry should be able to function without tariffs or any other form of subsidy unless it is subject to unfair competition. What is needed is technological progress unhampered by over-insistence upon the financial past as dictating policy. One form of the ultimate absurdity is reached when an obsolete and ill-maintained plant is kept in operation on the ground that since it involves no capital charges, it can operate more cheaply than a new plant working with the highest efficiency. It is a little difficult to detect wherein lies the fallacy of this from an accountancy angle. But a plant obviously becomes obsolete when it is considerably less efficient than other plants turning out the same product.

All this does not mean that accountancy should have no place in the management of business. Very much the reverse. It means that the deductions of accountancy must be qualified by those of technology. Dr. Cohoe foresees "the gradual domination of the technological mind over the accounting habit and attitude." It is difficult to see how an accountant working by himself can even determine accurately the cost of operation. The engineer must be called into collaboration, for there is much that the accountant cannot know about the process he is endeavouring to put under the financial microscope. At the same time, the technologist, in his desire to advance, must "carry some accounting ballast in order that his flights into the realms of constructive imagination do not take him too far above the reality of practical considerations."

A very real difficulty in many businesses is that the engineer or the scientist has to satisfy a non-technical head of the soundness of his plans. If the engineer presents his plan properly, with due regard to the lack of understanding and psychology of those in control, he should get it accepted if it is sound. But Dr. Cohoe evidently finds in America the same difficulties that we find in this country for he says: "Every technologist knows, when a chief executive rejects a presented plan on the grounds that it is 'too theoretical,'" that he simply does not know what it is all about. Instead of taxing the executive with ignorance the technologist should, in many cases, blame himself for a faulty presentation."

And there, perhaps, we shall be wise to leave this very debatable subject, lest we also are blamed for being too theoretical.

NOTES AND COMMENTS

The Plastics Position

MORE irresponsible rubbish, we believe, has been written and spoken about plastics than about any other branch of scientific industry—though the production of commercial power from nuclear energy must now be running it pretty close. Consequently, Dr. Yarsley's summing-up of the present position of plastics, and their future prospects, delivered before the International Technical Congress in Paris this week, is doubly welcome—both for its own sake and for the misapprehensions it must help to remove. We make no apology, therefore, for publishing it substantially in full; since, so far as we know, no similarly brief and concise statement of the facts has yet appeared. Some excellent books on plastics have been published, and many admirable articles in the technical Press have dealt with various aspects of the subject; but we believe that this is the first occasion on which users of the multifarious materials included under the head of plastics have had the position put to them *en bloc*. Dr. Yarsley is to be congratulated on his excellent combination of the caution of a scientist with the optimism of a man of vision. An interesting point is his abandonment of the conventional terms "thermosetting" and "thermoplastic" in favour of the more accurate "thermohardening" and "thermosoftening." We wonder which pair will eventually find its way into the established language.

The Written Word

BY the death of Sir James Jeans, science has lost one of her greatest and most lucid exponents. It is not for us to record here his achievements in the sphere of cosmogony and stellar physics, but his lifework embodies a lesson for every scientist, especially for such as seek to communicate the results of their efforts to a non-specialist public. There could hardly be a more abstruse or recalcitrant subject, from the point of view of dissemination to the public, than the branch of science which Jeans made peculiarly his own; yet he contrived to write upon this very subject what was nothing less than a "best-seller." No more striking proof than this could be demanded of the contention (one we are continually making) that it is quite possible to "put science across" to the multitude. What is perhaps even more interesting, in the present instance, is that Jeans did not set out to be a "populariser" of science; he simply had the rare faculty of expressing his ideas in words that could mean something to the man of average intelligence. Naturally, we do not expect every scientific writer to have that faculty in an equal degree; but Jeans is the cardinal example of how much can be done by avoiding professional jargon. It appears that Sir Richard Gregory was the first to call the attention of a wide scientific public to the clarity of Jeans's expression (not the only service of the kind he has performed), but it was the publication of *The Mysterious Universe* in 1930 that brought Jeans a really universal audience; and those who heard his presidential address to the British Association in 1934 realised that that was no isolated example of his powers. It will be long before we meet the equal of Jeans; but his achievement has set a standard of scientific writing which his lesser colleagues in the field of science might well try to approach in their humbler way.

Rare Chemicals

OVER 8500 uncommon compounds, some of them in fractions of a milligram, make up the "stock-in-trade" of the National Registry of Rare Chemicals in the United States, which is directed, free of charge, by the Armour Research Foundation, 35 West 33rd Street, Chicago. In a brief account of the Registry's activities (*Chem. Eng. News*, 1946, **24**, 2173), Frances Knock gives some indication of the services that it has performed during the four years since its foundation on June 1, 1942. Established primarily with the purpose of speeding up war-time activities, the Registry has answered over 8000 inquiries from every continent of the globe, and has satisfactory documentary evidence that these answers have indeed led directly to the successful conclusion of many enterprises which, without them, would have been unduly prolonged or even doomed to failure. All types of chemist have required the information, and the suppliers of the informtion have been equally varied. The Registry does not normally buy or sell chemicals—merely passing on information about where they may be obtained—but, where anonymity is an essential, it will act as commercial intermediary with-

out disclosing the name of the supplier, a valuable service where "trade secrets" may be involved. To trace the sources of certain chemicals, the staff of the Registry searched the literature of the last ten years for likely suppliers, and these researches were often rewarded with success. The information required includes the full chemical name of the compound, the position of any substituents, and the approximate amount available, with data on purity where possible. Release of this information in no way obliges the possessor of the chemical to dispose of it, though it is generally assumed that a release of some of the compound is contemplated, if suitable terms can be arranged. The Registry envisages even greater service to the world of research. Is it chimerical to suggest, now that the time-dimension of the world is so rapidly shrinking, that it might change its name to "International Registry of Rare Chemicals?"

U.S. Research

MORE money than ever before is now being spent on research projects in the United States, the latest estimate of the annual expenditure in this direction being put at $500,000,000. Even more interesting is the statement that the chemical, pharmaceutical, and petroleum industries are leading in the volume of research. One striking development in connection with post-war chemical research in the U.S. is the great increase that has taken place in the amount of work "farmed out" by industrial concerns to private research organisations. Most of this type of research work is being undertaken on behalf of companies which have neither laboratory facilities nor a scientific staff, but even industrial concerns with extensive research facilities of their own are making use of private research. This trend is largely due to the fact that the outside research group offers many inducements for special investigations which can be carried out without interruption in an organisation separated from production operations.

Science is Power

THE general expansion now taking place in chemical and allied research, together with the rapidly increasing membership of the American Chemical Society, lends added significance to the Society's slogan: "Science is Power." The Society now has a membership of more than 47,000, which is an increase of over 5000 on the figure of a year ago. At the Society's 110th national meeting, held at the beginning of this month, no fewer than 726 papers were presented. This is the largest number ever read at a meeting of the Society and they dealt with advances in 17 branches of chemical science and technology. The contributions of chemists in the world-wide war against hunger, recent discoveries concerning the potentialities of radioactivity, and the war-time harnessing of the unruly gas, fluorine, opening up a vast field to industry, were among the triumphs reported, and progress in the fields of insecticides, plastics, and synthetic rubber were also described.

Wholesale Prices in August

IN contrast with the violent movement reported in July, the alterations in wholesale prices, so far as chemical and metallurgical materials were concerned, were comparatively slight, as recorded by the Board of Trade, although a rise of 2.2 per cent. in the index figure for iron and stell was the steepest ascent which those commodities have experienced since January, bringing the figure from 206.4 up to 211.1 (1930 = 100). Various groups in this sector were affected, the greatest rise being about 17 per cent. in the f.o.b. price of tinplate. Manufactured iron prices were freed from control on August 14, with resultant increases of between 5½ and 7 per cent. Non-ferrous metals, with an increase of only 0.1 per cent. (from 161.2 to 161.4), were much less disturbed in price than during the previous monthly period, a slight increase in lead pipes and sheets being the only one recorded. Among "chemicals and oils," the slow but steady rise, which has persevered without a break during the year, continued unchecked, the index figure going up from 147.8 to 148.2 (0.3 per cent.). The average price of soap increased by about 1½ per cent., as a result of the advance in July; the only notable increase that took place actually in August was a 5 per cent. advance in the price of chalk lime, which is "weighted" in the table at the figure of 0.5 per cent.

A world conference on mineral resources will be held in connection with the 75th anniversary celebrations of the American Institute of Mining and Metallurgical Engineers in New York during the third week of March, 1947.

Plastics

The Modern Materials of Construction*

by V. E. YARSLEY, D.Sc., M.Sc., F.R.I.C.

Dr. V. E. Yarsley

ALTHOUGH the pioneer plastic, celluloid, is now almost 70 years old, most of the materials and processes which form the basis of the modern plastics industries have been developed during the past 25 years. To-day, with certain notable exceptions, we regard as plastics those organic materials which, although they are rigid solids in their finished state, are at some stage in their production capable of flow, and can be caused to take up a desired shape under the action singly or together of heat and pressure. The raw plastics are largely the products of chemical synthesis, prepared from simple raw materials which are widely distributed over the surface of the earth. It follows, therefore, that the plastics industries are in general terms "footloose," and can be established at will in the world where necessity or economy dictates. The raw plastics are available to industry in the form of sheets, rods, or tubes, in powder or liquid form, and can in some instances be worked and applied by methods long since developed for conventional constructional materials.

I do not propose to worry you with the chemical nature of the plastic materials. These belong to between 30 and 40 different chemical types, but they can be broadly and more simply grouped under two headings. These are the thermosoftening group which, up to the point of chemical decomposition, are continuously heat-sensitive, and include the pioneers celluloid and cellulose acetate, and also the later synthetics such as the vinyl, styrene, methacrylate, and ethylene polymers. The second group includes the materials which when once heated to a specified degree, or "cured" as we say in the industry, are thereafter insensitive to moderate heat. These are the thermohardening plastics which include those of the bakelite and aminoplastic families, and the more recently developed allyl polymers.

Four Groups

The plastics industries proper can be broadly divided into four groups: (1) the manufacturers of the raw plastics in the form of sheets, rods, tubes, powders, and syrups; (2) the moulders, who take the powders and by processes of compression, injection or transfer moulding or by extrusion, form these plastics into the finished products of a thousand uses; (3) the fabricators, who manipulate the sheets, rods, and tubes, by processes which are broadly analogous to those long since applied to metals; and (4) the laminators, who impregnate fibrous reinforcing materials such as paper and fabrics of all types with plastic bonding agents, producing therefore yet another series of sheets, rods, and tubes of considerable strength yet low density, which again are applied much as are their metal counterparts. This group has extended and, indeed, revolutionised the industry which has long passed under the designation of "plywood," and this to such good purpose that materials of this type were mainly used in the construction of the "Mosquito" plane of war-time fame.

Closely related to these groups which constitute the plastics industry proper, are those which use plastics as their raw materials, mainly in solution form. These include the manufacturers of certain types of rayon and transparent films, also the producers of surface coatings, adhesives and cements. It is of interest to note in passing that surface coatings for furniture, motor cars, etc., absorb a greater tonnage of synthetic plastics than does the moulding industry itself. This branch of the industry also extends to the treatment of fabrics to render them waterproof or crease-resistant.

The idea is widespread, but entirely mistaken, that plastics are the basis of huge industries throughout the world. Most certainly they are used as ancillary raw materials by an ever-increasing number of industries, so much so that it is becoming increasingly difficult to say where the plastics industries actually start and finish. Even swollen by war demands, it is doubtful if world production of plastics proper (that is excluding the so-called synthetic rubbers) exceeds the million-ton mark per annum. Unfortunately, very few production or other reliable statistics are available outside America, but according to

* Slightly abridged from the paper presented by Dr. Yarsley to the International Technical Congress, Paris, September 16–21, 1946.

statistics published early this year by the Society of Plastics Industry in New York, the American plastics industry employs about 85,000 persons, and in 1944 produced 450,000 tons of material with a dollar valuation approximating to 500 million. For many years America has had the lion's share of production in plastics, followed by Great Britain and the Empire Countries, Germany, France, Russia, and Japan. How far production in the future will be confined to the countries of the United Nations, or to what extent the vast natural resources of South America and India will be explored for the expansion of world plastics, remains to be seen.

The Significance of Plastics

To appreciate the full significance of plastics and to appraise the impact of these new materials on world industry, we must trace briefly the rise of these new industries during the present century, and in particular examine the changes in outlook which have been the consequence.

The production of some of the pioneer plastics was prompted by a desire to find suitable alternatives to some of the rarer natural materials. Thus the search for an alternative to ivory for the production of billiard balls inspired the discovery of celluloid, while the desire to reduce the fire risk on this new material resulted in the development of cellulose acetate plastic, earlier known as "non-inflammable" celluloid. The desire to produce a resinous material alternative to shellac and other natural products prompted the early work of Baekeland. This latter success was far more momentous than was at the time appreciated. Up to this time the classical outlook on organic chemistry, which since Wöhler's synthesis in 1828, had persisted with the recognition, as useful products, of only the defined crystalline or liquid compounds. Baekeland's changed outlook, which enabled him to evaluate the ill-defined resinous masses, was as epoch-making in the history of organic chemistry as had been Wöhler's original urea synthesis. The old concept of precise molecular chemistry faded away and gave place to the organic chemistry of undefined molecules, the chemistry of large molecules and long chains, structures long recognised in nature yet hitherto not copied by man. Thus were laid the foundations of large molecular chemistry, which we now know under its modern name high-polymer chemistry, and the foundations of those industries which we to-day designate as plastics.

The first phase in the development of the modern plastics industries followed rapidly on Baekeland's pioneer work, and in rapid succession came a large number of products of many different chemical types both thermohardening and thermosoftening. During this period we find almost always the same incentive, the desire to produce a material, followed by efforts to find an application for it in industry. Such a method of approach was inevitably hit-and-miss, and while it produced some satisfactory results it was responsible also for some dismal failures. As always, the failures were most observed by those industries and the using public who had suffered. Naturally also these man-made materials were applied in many instances to purposes for which natural products had formerly functioned. Thus it came about that, with failures in mind, the public was biassed against what they termed "substitute" materials.

Nevertheless, in spite of early failures, the new materials recorded many successes, and as the new plastics industries became established, they had time to devote to the consolidation of their position in the general body of industry. Progress in this direction was increased by yet another fundamental change in attitude. The successes which synthetic chemistry had attained in other fields—notably dyestuffs and pharmaceuticals—had shown the possibility of "tailor-made" molecules, so that chemists approached the problem from the user end, building up a product having a structure calculated to give the desired properties. The outstanding example of this changed approach is the success which attended the synthesis of nylon by Carothers and his co-workers in the Du Pont laboratories, which must surely rank for all time among the epic pieces of long-term planned research. With the chemists and physicists carefully building up their long-chain polymers having predetermined architecture, and the engineers perfecting methods and plant for working them, the new plastics industries advanced through this first phase of development. In spite of much spectacular progress, industry, as much as the average man-in-the-street, remained sceptical of the new materials, and ultimate progress might have remained slow but for the advent of World War II.

First Real Chance

The shortage of the conventional materials of construction occasioned by the last war gave plastics their real chance, although it must be appreciated that this was their first real production crisis. As in most other branches of advancing technology, war-time development in plastics was intensified in all the belligerent countries to the utmost limits of staff, plant, and raw materials. We are as yet too near these events to be able accurately to assess the progress we have made, and many developments are still on the secret list. It is fairly certain, however, that not only in terms of technological development, but probably even more so in the receptivity of

the other industries to the use of the new materials, plastics progressed several decades during the war years. I stress the importance of the latter, more psychological, progress, because this represented a changed attitude of the user towards plastics, without which few substantial advances could have been achieved. Risks which private enterprise could never have taken both in the production of new materials and in their ultimate use, were taken on behalf of the State when the national need called for it. When natural rubber went out with the fall of Pearl Harbour, plant to produce a million tons of synthetic rubber-like plastics was quickly forthcoming.

Thus, as I have already suggested, we stand at the end of World War II, at the end of the first phase in the development of the plastics industries. From the present-day high peak of technological achievement we view what may be a truly remarkable future for mankind, provided only that the sociological can be made to keep pace with the technological progress.

Plastics Applied

It is no part of the present survey to detail applications of plastics in the various fields of engineering, but I feel that it may be helpful to review their possibilities for usefulness in general terms. Of the outstanding advantages offered by plastics, low density is possibly among the most attractive to the engineer. A range from 0.95 for polythene to 1.7 for polyvinylidene chloride offers many possibilities against metals, if backed by ancillary properties. On the other hand, tensile strengths of 2000 lb./sq. in. for polythene up to 20,000 lb./sq. in. for rolled nylon, or 30,000-50,000 lb./sq. in. for special laminates may not be very impressive in a comparative table. These and other constants such as compressive strength, Young's Modulus, and impact strength may deter the engineer from using plastics in his structures. What the engineer must consider is not how far short in mechanical properties is a particular plastic compared with steel or aluminium, but has the plastic the necessary properties for those special key applications which can carry its cost. It is of little consequence that plastics have not the required mechanical strength to enable them to be used in rebuilding the Eiffel Tower, should this be necessary, for the simple reason that it would be a profligate waste of plastics to consider any such application.

Again by comparison with metals, the thermal properties of plastics are restrictive of their indiscriminate application. Most plastics function reasonably down to $-40°$C., while nylon, with a melting point above 250°C., can be used safely up to 200°C. Standard thermohardening mouldings and laminates are serviceable at 140-160°C. The coefficients of linear expansion of plastics are generally higher than those of commercial metals.

It has been suggested, with a certain degree of truth, that apart from cutting edges and units which have to withstand direct heat, plastics could meet all the material needs of mankind. Whether this can be done economically is entirely another question. Nevertheless the engineer has in plastics a range of constructional materials of wide possibilities, but certain definite limitations. Broadly speaking we can sum up plastics by saying that they offer the strength of some metals with the lightness of wood. They are poor conductors of heat and electricity, and are in the main reasonably resistant to the action of moisture and agents which the engineer has come to regard as corrosive. Among one or other of the chemical types of plastic it is possible to obtain, within reason, from either plastics alone or allied with other materials, almost any desired physical and mechanical property, except resistance to substantial heat, and even this is being remedied to some extent in those plastics in which the element silicon replaces partially the customary carbon.

One of the fundamental limitations of plastics is their relatively high cost, and even though production is stepped up considerably, as it certainly will in the next few years, we cannot expect plastics to compete on a cost basis with the conventional materials of construction. Thus except for purposes where their special properties are required, plastics will not compete to the exclusion of bricks and mortar, iron and steel, wood and glass. Rather shall we expect to find plastics co-functioning with these materials to improve existing methods of construction.

Scarcity of Raw Materials

Another limitation is the relative scarcity of the raw materials for plastics. Albeit these, such as cellulose, are widely distributed over the earth's surface, to put them in a form in which the plastics industry can take them is a major chemical operation. That wholesale extensions of chemical plant are possible has been shown many times during the war, and one has only to take the synthetic rubber programme in America as an example: nevertheless, to step up chemical synthesis to the point where plastics could start to compete seriously with metals would be an economic impossibility. There is, in fact, a total absence of any justified need for the wholesale substitution of plastics for conventional materials in in what one may term the major industrial applications. The rôle of plastics can still be sufficiently important in collaboration with conventional metals, woods, and ceramics, to bring about a mild revolution in

engineering construction in the next decade. One has only to look to electrical engineering for confirmation of this point; here the introduction of the superior plastics insulating materials has made possible designs and indeed types of machines which would have been impossible a decade ago. The introduction of plastics to combat the ravages of corrosion, to take another isolated example, has again opened up new possibilities for construction, and at the same time increased the efficiency of machines while lowering their running costs substantially.

Assisting the Engineer

Quite apart from the use of plastics in the many fields of engineering construction, there is one application to which I would make reference in which plastics—more particularly transparent plastics—will aid the engineer, and that is the production of scale models. When he had to take unskilled labour into his shipyards, Henry Kaiser used models of his ships in transparent plastic for demonstration purposes. An operative who could not read a blueprint could nevertheless see where his unit fitted into the main structure. Such models have further possibilities in the production of unconventional load-bearing structures. Strains applied to models in transparent celluloid sheet will develop stresses which can be located by the use of Polaroid viewers.

The use of plastics as protective and decorative coatings for metals, woods, and fabrics is too well known to need further mention, but special attention may be drawn to recent developments in the methods of applying the layers of protective plastic. Conventionally plastics have been applied in solution form, a technique which developed with the so-called synthetic lacquers for motor cars in the early 1920's. The spraying of the plastic dissolved in a volatile solvent, while quite satisfactory for some purposes, cannot be universally applied, and indeed this method is inapplicable to certain plastics, which are either insoluble or almost so in commercial solvents. This difficulty has been overcome by the flame-spraying of plastic, in a special gun, which was devised and perfected for the spraying of metal powder. The plastic in finely powdered form is projected at high speed through a controlled blowpipe flame directly on to the surface to be coated, the individual particles then being melted and caused to flow into a uniform layer by further application of the blowpipe flame suitably modified. This method of spraying has made possible the uniform coating of difficult or irregular surfaces, also the application of plastics such as certain thioplasts, which have hitherto been regarded as beyond the range of materials normally available for surface coating.

The use of plastic materials as bonding agents and cements is one which has received considerable stimulus from the exacting war-time demands. Not only have the so-called "synthetics" replaced many of the conventional water-soluble bonding agents, but they have actually competed successfully with soft solders for specific purposes. Many proprietary brands of plastic cement are now available which will give efficient metal/metal seals, under specific conditions. The possibilities of this development are at once apparent, but it must not be taken as implying the widespread use of plastics to the exclusion of rivets or brazing. Many of the plastic bonding agents used are thermosoftening, so that the temperature limits of their application are very definite. Within these limits, however, there are many possibilities, such as the sealing of extruded aluminium tube in the production of cycle frames, or the bonding of T-section aluminium rod in the fabrication of window frames. The plastic bond is speedy in operation, and since it is effected in the cold, it has obvious advantages in comparison with welding. Admittedly, the development of the metal/metal plastic bond is in its infancy, but enough has been done to convince the most sceptical of its ultimate possibilities.

Plastics and the Future

As we look around on the many difficulties which face the statesmen of the world, we realise that it would be a truly brave man who would attempt to prophesy the future of any particular branch of industry. As scientists we confine our attentions to scientific fact, and we can only draw conclusions as to possibilities on the assumption that world order can be established in line with the hopes so fervently expressed in the various war-time manifestos. To this end let us take stock of our position as far as plastics are concerned, at the opening of what I would suggest is the second phase in the development of these new industries, their advent at adult status. In evaluating the future possibilities of plastics we are concerned not only with fundamental principles but also with psychological considerations, and it is under this latter heading that I would make a final suggestion to the engineers who apply the new materials in the service of man. I have already stressed that it was the changed viewpoint on the part of the organic chemists which made plastics possible in the first place. Just as assuredly would I suggest that a change in the approach of the engineers who apply plastics can alone ensure that they attain the maximum possible success in service. Engineers, with their long experience of conventional materials, must realise that in plastics they have something unique, and

not just substitutes for materials long since known. This change in attitude has been necessary in other industries such as the man-made fibres, where progress was slow as long as these were looked on as artificial silk. When they were recognised as "rayon," something quite distinct as natural fibres, both in their processing and use, real progress became possible.

So with plastics, the engineer who applies them must be aware of the key rôle he has to play. Not only must he be careful in his selection of the materials, but he must be more than ever design-conscious. Plastics cannot be applied by mere analogy with metals. The engineer must design not only in plastics but for plastics. On this important question of design I would like to dwell at greater length if time permitted. Suffice it to say that many of the early setbacks which plastics encountered can be traced either to the wrong application of materials, or to mistaken ideas of design. Bitter experience has demonstrated the impossibility of producing plastic units on lines parallel to metal prototypes. Not only must full attention be paid to the varied properties in use of metals and plastics, but due consideration must be given to the conditions of processing which are applied to the plastics. That is why I postulate that it is of fundamental importance for design plastics as well as in plastics.

Use of Colour

Equally important in this connection is the question of the correct use of colour in design of plastics. Unique among constructional materials, plastics offer colour possibilities, ranging in certain types from complete transparency through every possible colour value which chemical synthesis has made possible. Plastics can also be metal-filled or coated with metal, while the properties of certain transparent plastics make it possible to "pipe" light through them to give remarkable luminous and fluorescent effects. In plastics, therefore, designers have possibilities of combining colour and form as never before with constructional materials.

I would like to conclude these remarks by expressing at this international gathering the fervent hope that these materials, which have been made possible by the collaborative effort of men of many nations, may in the not too distant future have an opportunity to make their special contribution towards the establishment of a world of peace and plenty.

"The Triumph of Synthetic Rubber" is one of a series of radio talks reprinted in *From the Research Laboratory to the Armed Forces*, free copies of which are obtainable from the Mellon Institute, Pittsburgh, Pa.

Industrial Chemicals

Courses at the Cass Institute

THREE courses of lectures, of interest to industrial chemists, have been arranged by the Sir John Cass Technical Institute, Jewry Street, London, E.C.3. Two of them are in the special province of the Department of Chemistry, the third is of more general interest. Applications for enrolment should be made to the Principal of the Institute *before* the opening date of the course, if possible.

On Fridays at 6 p.m., beginning on October 11, there will be a course of 20 lectures on *Some Materials of Construction and Some Fundamental Operations*. Lecturers will be distinguished chemists and chemical engineers, the great majority actually engaged in the industry—such firms as the United Steel Companies, Haughtons Patent Metallic Packing, Thermal Syndicate, Hathernware, Mond Nickel, A.P.V., Kestner, and Johnson Matthey being represented in the constructional section, and others of equal reputation in the operational section. The fee for the course is 30s.

An advanced course of 19 lectures (fee for the course 30s.) on *The Chemistry and Utilisation of the Less Familiar Elements* will be held on Wednesdays at 6 p.m., starting on October 16. Here the lecturers are drawn from Johnson Matthey, Murex, and Thorium, Ltd. Apart from general chemistry, the spectrography of the rare earths will be covered; also the analytical chemistry of the platinum metals.

The third course, on Industrial Law, will consist of 12 lectures by Mr. Eric Walker, B.A., B.C.L., of Grays Inn, and is addressed to men and women in executive and administrative positions in industry. The lectures will be held on Tuesdays at 6 p.m., starting on October 1, and will cover contracts, rights, relations between employer and employee, patents, trade marks, etc. The fee for the course is 10s.

Each lecture will last from 1¼ to 1½ hr.

IRON AND STEEL OUTPUT

Figures issued by the Ministry of Supply (Iron and Steel Control) show that there was an increase in the U.K. production of pig-iron and steel during August. The weekly average production of pig-iron was 145,300 tons, equal to an annual rate of 7,558,000 tons, as compared with 122,300 tons for August, 1945, equal to an annual rate of 6,358,000 tons. The production of steel ingots and castings was at the weekly average rate of 225,900 tons, equal to an annual rate of 11,747,000 tons, as compared with 182,000 for August last year, equal to an annual rate of 9,465,000 tons.

LETTER TO THE EDITOR

B.A.C. and T.U.C.

SIR,—I am very interested to note that "Non-Socialist Chemist" was one of the original members of the B.A.C., a privilege which I share with him. On looking back, however, I feel that the enthusiasm to which he refers would be better described as furious indignation because we were paid just about half as much as the plumbers who constructed and maintained the plant which we designed and operated.

The universal expressions of dissatisfaction did secure increased remuneration in 1918, but as soon as the chemists received as much as the plumbers they seemed to be satisfied and it took about eight years to enrol the next 200 members. May I invite your correspondent to write to me and tell me what he thinks the B.A.C. should do and to offer his assistance in achieving his objects?

For the benefit of those who are not members may I explain that the huge funds provide a substantial backing for an unemployment benefit fund, from which an unemployed chemist can draw up to £6 5s. per week. It is the admiration of all who run such schemes. Even to-day chemists are unemployed and draw benefit. We are considering extending the scheme to cover unemployment through ill health and hope to be able to provide an income for those who become totally incapacitated and can never again work. Unfortunately we have such members. We are working on a plan to provide for a transferable superannuation scheme. Many members derive financial benefit from other schemes which more than pay for their subscription. At least 10,000 chemists could join and follow their example. We have other plans which could be speeded up if more of our members would do some work for the Association. The "dwindling membership" consists of the removal of the names of those who have not paid subscriptions for many years and who in most cases cannot be traced. Many associations continue to count them in order to swell the membership figures.

"Non-Socialist Chemist" has taken up nearly two columns of your paper in complaining about sloth and torpor, but there is not a single word to indicate what he thinks we ought to do. We await his bright ideas and his effective leadership.—Yours faithfully,

NORMAN SHELDON,

London, W.1. September 16.

The Thermal Syndicate, Ltd., has issued a new price list of Vitreosil pure fused silica tubing. Copies of this are obtainable from the head office, Wallsend, Northumberland.

Paint Chemists' Prize

Memorial to the late F. W. Clark

TO commemorate the late Francis William Clark, of the Distillers Co., Ltd., and long associated with British Industrial Solvents, Ltd., the "F. W. Clark Memorial Prize" has been founded by the Oil and Colour Chemists' Association. F. W. Clark was the "English chemist" who was reported as among the "missing" in 1942 when the ship on which he was sailing to America, on an important business mission, failed to reach its destination.

The sum of £250 collected to form a memorial has been handed to the O.C.C.A., whose Technical Education Committee has now formulated a prize scheme for the encouragement of students—a subject in which F. W. Clark was always interested. It is now announced that the prize shall be awarded annually for the best essay (1000-5000 words) dealing with any subject (chosen by the candidate) with which the O.C.C.A. is concerned. The prize is to consist of books, instruments, or other gift of value to the candidate in the pursuit of knowledge and experience in his industry. Candidates must not have reached their 21st birthday on the last date by which papers must be received by the Secretary of the Association—in the present instance, April 30, 1947. The winning paper shall become the property of the Association; presentation of the award may be made either at the annual general meeting or the annual dinner of the O.C.C.A.

Awards to Inventors

Royal Commission's Pamphlet

THE Royal Commission on Awards to Inventors has issued a pamphlet containing the relevant part of its "terms of reference," the rules regulating the procedure before the Commission, and general instructions for the guidance of intending claimants before the Commission (H.M.S.O. price 2d.). The Commission will not begin its public hearings of claims before November 12 and a further announcement of the times and dates of sittings will be made in due course. Details of cases to be heard will be published in the Daily Cause list. While in no way bound by the rulings and decisions of the similar Royal Commission set up in 1919, the present Commission will in general have regard to the priniciples and policy adopted by that Commission. Communications intended for the Commission should be addressed to the Secretary, Royal Commission on Awards to Inventors, Somerset House, Strand, London, W.C.2.

Dunlop's New Factory

Conversion from War to Peace at Speke

WHAT is believed to be the first example of rubber processing and manufacture proceeding in one straight flow line throughout a factory is to be seen at the Speke (Liverpool) factory of the Dunlop Rubber Co., Ltd. Built originally as a Government "shadow" factory on a site of 101 acres, not far from Speke Airport, the factory was occupied throughout the war by Rootes Securities, Ltd., who built nearly 5000 aircraft there.

The Dunlop Company did not take it over officially until August 1, 1945, and although many conversion difficulties had to be overcome, the factory is already providing employment for more than 4000 people, who are turning out rubber tyres, footwear, golf and tennis balls, and other equipment in ever-increasing quantities. When the installation of new plant has been completed, it is expected that there will be regular employment for between 6000 and 7000 people.

The factory, which covers 1,400,000 sq. ft., was the first of the war-time factories to be allocated by the Government for peacetime production, and V2's were still dropping around the Dunlop head offices when the conversion project was mooted. The decision to convert the factory to rubber processing and the manufacture of rubber products was not an easy one to take, as an initial survey disclosed at once that the main supply services then available—electric power, water supply, and steam-raising plant—were far below the requirements of a rubber factory. There was, in fact, no steam supply, as the boiler house was installed only for water heating. On the other hand, the height and span of the main building were satisfactory, and the design of the factory generally was attractive.

Foundations

In rubber processing, very heavy machinery is employed in such early operations as mixing, calendering, and extruding, and careful consideration had to be given to the provision of suitable foundations. Altogether, the major equipment weighs 5000 tons; the electrical plant 600 tons; and the engineering services plant, including drives, etc., but excluding piping and mains, 500 tons. Fortunately, the factory is on good clay, and this was an advantage, little or no shuttering being required for the very deep foundations and for the autoclave pits at the other end of the production line. There are 58 heavy foundations, which, together with their service trenches, required 20,610 cu. yds. of excavations and 9611 cu. yds. of concrete. Two autoclave pits alone required the excavating of 2270 cu. yds., and nine internal mixer bases required the excavating of 1188 cu. yds.

A modern rubber-mixing mill consists of internal mixing machines discharging by gravity to the sheeting mills below, and such plant requires a high building. In this case it was considered necessary to have minimum headroom of 30 ft., plus space above for a 15-ton crane, and as the north end of the main building had such height it thus determined the location of the mixing mills, and, in turn, the direction of flow of the operations, this, incidentally, being the reverse of the flow when the factory was producing aircraft.

This north-to-south flow of operations also enabled the curing or vulcanising to be brought close to the steam generation or boiler house; moreover, it determined the position of the newly-constructed pump room, so that the distance from the generation of a particular service to the consumption of that service was brought to the irreducible minimum.

Mixing Operations

Special consideration had to be given to the mixing operations, notably the means for delivering and weighing gas and lampblack powders for the internal mixers. Here, cleanliness to the worker and the shop was regarded as an essential. This has been most successfully accomplished by the use of a special conveyor system in conjunction with a novel method of automatic weighing and dust collection, designed and developed by Dunlop engineers.

Several other novel features are to be observed in the mixing section, including a centralised control room, where the operations and process conditions of the mixing machines are observed and recorded; automatic sheeting and cooling conveyors for the rubber stock and a pneumatic system for conveying samples of the stock to and from the control laboratory room for each batch to be completely analysed before further processing. The mixings required for all manufactured products are carried out in this section.

For tyre manufacture the lay-out follows a directional flow of operations passing through the following operations: fabric calendering; tread extruding; component part manufacture; tyre building; tyre shaping; moulding and vulcanising; and finishing—inspection and despatch. A large part of the manufacturing floor space is allocated to the manufacture of rubber footwear, which is also laid out in progressional flow

from the delivery of the mixed rubber and processed fabric to vulcanising, where specially designed transporters are provided for loading and unloading the large-diameter vulcanisers. The equipment for the manufacture of golf and tennis balls has been installed in an enclosed area previously used for the spray painting of aircraft. The lofty "flight shed" has been allocated for conveyor belting production as the very large presses required for this work include heavy cranes, with plenty of headroom for the movement of the belts from the making sections to the curing sections.

Water-circulating System

An interesting feature of the process water-circulating system is that the greatest possible cooling capacity is taken from the water by re-circulation through the various processes at least three times. Such an arrangement allows for the primary water supply at the lowest temperature to be used on the more vital processes where cooling of the stock is an important feature. After the water has been used on this first circuit of the system, it is returned by gravity to a collecting sump and pumped back to the second water tank or sump and re-circulated through the less vital cooling processes. This operation is repeated for the third circulating system, and the water is then used either for flushing purposes or run to waste as its temperature by that time has reached a point where it is of no further use for cooling.

This system utilises the maximum cooling capacity of the water, and in doing so keeps to a minimum the initial quantity of water required from the two bore-wells. The total pumping capacity to achieve this is more than three times that for the initial water supply and is, in fact, of the order of 620,000 gals. per hour.

What has been written is sufficient, perhaps, to indicate the magnitude of the task involved in the change-over. That it has so far been accomplished is due to the good work of the staff, and to the help and co-operation of the engineering suppliers.

A selected party of technical Press representatives, including one from The Chemical Age, was taken on a conducted tour of the factory on Wednesday last week. They were received on arrival by Mr. G. E. Beharrell, managing director of the Dunlop Rubber Co., Ltd., who was accompanied by Mr. A. Healey, director of production; Mr. H. Willshaw, O.B.E., chief engineer, rubber factories; Mr. D. B. Collett, general works manager at Speke; and Mr. D. Crabbe, chief engineer at Speke.

Mr. Beharrell presided at luncheon, when the principal guests were the Lord Mayor of Liverpool, Alderman Luke Hogan, with whom was the Lady Mayoress; and Sir Philip Warter, Controller-General, Factory and Storage Premises, Board of Trade. Proposing the health of the Lord Mayor and the future prosperity of the City of Liverpool, Mr. Beharrell dealt with the reasons for the decision to establish the factory at Speke, and spoke appreciatively of the ready co-operation received from the civic authorities and the major suppliers of equipment, etc. He said they had had encouraging results in the training of labour in new and strange work and looked forward with confidence to a steady increase in employment and production, although the supply of raw materials, other than rubber, continued to cause some anxiety. In his reply, the Lord Mayor said he shuddered to think what the Liverpool unemployment position would have been if the Dunlop Company had not taken the Speke factory. He was very pleased to find that 50 per cent. of the employees were men.

The health of Sir Philip Warter was proposed by Mr. A. Healey, who said the taking over of the factory was a big adventure, but the company felt sure of success. They greatly appreciated the help received from Sir Philip and the Board of Trade generally. Sir Philip suitably replied, remarking that he was grateful to Dunlop's for taking over what at first sight appeared to be a "white elephant" from the point of view of the structure of the factory.

Mr. E. H. Hurlston, technical superintendent, is in charge of the central laboratory, and he is assisted by Mr. W. A. Clarke, physicist; Mr. H. C. Guthrie, chemist; and Mr. H. J. Walters, in charge of processing.

French Chemical Finance

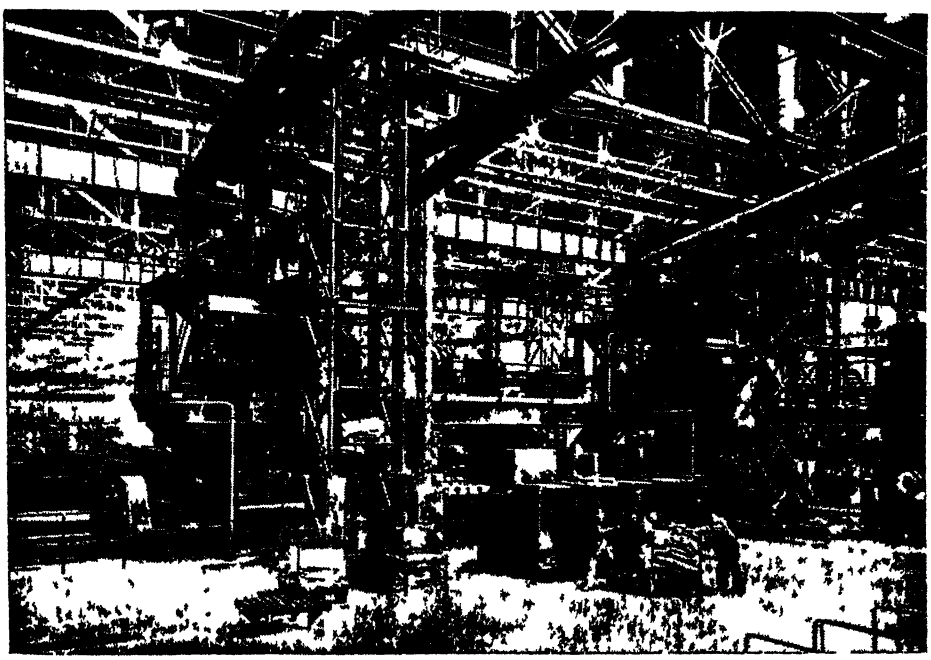
Company's New Shares

THE well-known French chemical company, Etablissements Kuhlmann, is issuing one new share for each share already held. Last year the company launched a Frs.250,000,000 3½ per cent. bond loan and obtained acceptance credits up to Frs.400,000,000 from the Crédit National, the State bank for financing reconstruction.

The purpose of the new appeal is to replenish working funds in view of the continuous rise of prices. For 1945, Kuhlmann recorded an operating loss amounting to Frs.70,000,000, which was offset by extraordinary profits resulting from the devaluation of the franc. During the occupation it became the second chief shareholder in Francolor, which was established by the Germans to control the entire French dyeing industry. Kuhlmann now shares control of Francolor with the French Government since the latter seized holdings held by I.G. Farben.

SOME OF THE PLANT IN THE NEW DUNLOP FACTORY

Fig. 1. (above). The giant tyre moulding plant in the new Dunlop factory at Speke, showing the autoclaves in the centre. Fig. 2 (below). Part of the rubber mixing and handling equipment. Carbon black is unloaded in an enclosed room and taken by a system of conveyors (seen at the top of the picture) to a weighing device above the mixer. A known quantity is then discharged into the mixer. It is possible to feed two varieties of carbon black to each mixer.



Metallurgists and Atomic Energy

Sir C. Darwin at Institute of Metals Luncheon

THE opinion that atomic energy would provide a very interesting new application of metallurgy was expressed by Sir Charles Darwin, Director of the National Physical Laboratory, when he proposed the toast of "The Institute of Metals" at a luncheon held by the Institute at the Connaught Rooms, Great Queen Street, London, W.C.2, on Thursday last week. The luncheon, which was held in conjunction with the autumn meeting of the Institute, was the first for seven years.

Sir Charles qualified this opinion by adding that the most interesting thing, however, was not always the most obvious. The most obvious thing was that they had to learn much more about the metallurgy of uranium and other metals of that kind, but of greater interest and importance were the other metals which would come into the devising of any machine for atomic energy. The chemical character of those other metals was of importance, but it was the nuclear character of those elements which was of paramount importance.

New Assessment of Elements

He thought the Institute might feel that it rather had the laugh of its brother, the Iron and Steel Institute, because it happened that iron had a particularly discreditable nucleus, with the result that all the engineers working in connection with atomic power would have to struggle very hard to avoid dealing with iron. In consequence, investigation was required into a large number of the seventy or eighty metals. Some of them would have really well-behaved nuclei, and it would be the duty of members of the Institute to work out the engineering properties of those elements, so that they could be as good as the old-fashioned iron alloys which had been used in other engineering work. The effect of it would be, of course, that a good many elements which had hitherto been regarded as nothing but museum specimens might easily become quite important.

The indirect impact of atomic energy was even more important. They would have seen a certain amount in the Press about the use of tracer atoms. By various nuclear treatments it was possible to make atoms of almost any element radioactive in such a way that a very minute trace of those atoms could be used to be quite certain, for instance, what impurities there were in any material. That was something which they could say with some confidence that they would be able to do within a matter of months rather than years; it belonged to the immediate future, and he expected that it would make a revolution in very many branches of science.

The most immediate branch which was most exciting was the biological sciences, because there it would be possible, and was already possible to a large extent, to find out a good deal about the behaviour of living matter. An unkind providence had provided, however, that the elements which were most tiresome to use as tracers were oxygen, nitrogen and carbon, and those were exactly the ones needed for biological work, so that although that work was the most important it was also the most difficult. In inorganic chemistry, with the great majority of the metals it would be possible with more or less convenience to produce tracer elements, so that they should be able to put some of their tracer into an alloy which they were making and be able to say: "All the copper that I put in has gone into the grains which are purple when looked at under the microscope."

Neglect of Thermodynamics

Sir Charles went on to say that there was a great subject in modern physical theories which seemed to him to have been unduly neglected, in particular in this country, and that was the subject of thermodynamics. It was a subject of the most desperate generality, but unfortunately one of the greatest generalisations about it was that almost everybody found it very difficult indeed to understand and to apply, unless he had been brought up on it. He had expressed the view to people abroad that there was not enough thermodynamics applied in metallurgy, and one man replied: "That is in England; we do it." There might be large parts of metallurgy where thermodynamics would have no application at all, but if it had none that should be known; it should not be just that they thought it had none.

He discussed with a prominent chemist the question of why people in this country were so bad at thermodynamics and he put it in this form: "Why is it that people in England have not the same easy confidence in talking about entropy that they have in talking about energy?" The chemist's reply was: "Well, I taught thermodynamics for many years, and I did it without ever talking about entropy at all, and that makes it much easier!"

Response to the toast was made by the president, Col. P. G. J. Gueterbock, C.B., D.S.O., M.C., who was in the chair. He said he felt confident the subject of nuclear physics would provide the Institute with many papers and discussions of the greatest

value. He was whole-heartedly in agreement with Sir Charles Darwin on the importance of thermodynamics in metallurgical studies, but, speaking for a small minority—the processers and smelters—he did not think they had neglected the subject. Some of their processes were based on the principles of thermodynamics, and had brought the industry, technically at any rate, to be well in the front of world practice. They might be a minority, but they had realised for many years the importance of thermodynamics.

He suggested that there were others besides metallurgists who might profit by a study of those principles. They were coming to a state, socially and economically, where "The Lord High Coachman on the box and the Lord High Vagabond in the stocks, all shall equal be." When he was very young he was taught that in a system where everything was the same temperature no useful work could be done, but in the economic and political sphere they were tending to a state of maximum entropy. Many of the fundamental facts on which thermodynamics was based applied to *homo* (so-called) *sapiens*, and perhaps their economists and statesmen might consider this dreadful word entropy.

Lieut.-Col. the Hon. R. M. Preston (past president) proposed the toast of "The Guests," and a reply was made by Capt. the Rt. Hon. Oliver Lyttelton, P.C., M.P.

SAFETY FIRST

Amenity as a Feature of Chemical Works—III

by JOHN CREEVEY

IN spite of the improvements which have been made during the past 20 years, there are still branches of industry with chemical interests which may be collectively grouped as "offensive trades." Here, considered distinct from all other directions, amenities offered to workers become of paramount importance, and when we recall some of the conditions which formerly existed it is a little surprising that anyone ever made it their work to engage in the industries concerned.

Offensive or noxious trades are, of course, subject to regulations by local authorities under specific statutory provisions. Some are enumerated in the Public Health Acts; others have been made the subject of special orders brought to statutory standing by powers conferred on local authorities under the Health Acts or the like. It is now just over 70 years since attention was first directed to the need for legislative action in this direction, for the first general inquiry into "the effluvium nuisances which arise in connection with various manufacturing and other branches of industry, especially with regard to the effect upon health of each such nuisance, and to the degree in which the nuisance can be prevented," was made in 1875 at the instance of the President of the Local Government Board. The report of the inquiry carried out by Dr. Edward Ballard, one of the medical officers of the Local Government Board, published 1882, is virtually a classic in the literature of industry, for it gives a complete and authentic record of the state of things existing in trades falling within the scope of the inquiry between 1875 and 1877.

According to the statements given in Dr. Ballard's report, the then existing state of affairs appears to have been due mainly to absence of scientific knowledge rather than to any unwillingness on the part of owners of works to incur expenditure on plant or to make special provisions to mitigate the nuisances and bad health conditions under which employees were working. Absence of proper scientific knowledge, in turn, brought inability to design plant for carrying out an offensive task in as clean and safe a manner as possible, especially in the treatment of the resulting unpleasant vapours which developed bad smells in the vicinity of the works as well as almost intolerable conditions within the works. Waste flesh, bones, fats, etc., were the staple materials entering into the manufacturing processes concerned, later to be followed by decaying fish and fish offal as the fish meal industry was developed.

In the attempt to improve conditions, steam was introduced for boiling purposes (in place of coal-fired boilers), and jacketed digesters were adopted, subsequently giving place to the concentrator, where, by further improvement, the vapours and evolved gases could be led away to be cooled and scrubbed in condensing plant, while the residual air and gases from the condensers were burned or perhaps more conveniently deodorised. All this was done before the outbreak of the 1914-18 war, when there was a notable expansion in the so-called

offensive or noxious trades, occasioned by the need for utilising "waste" materials to aid the war effort. The production of fish meal was then supplemented by meat meal for poultry and pig feeding, and simultaneously the large municipal abattoirs installed plant for the recovery of grease from condemned carcases as well as from offal, with the reduction of this valuable "waste" to a meat meal.

Foul Air Nuisance

Offensive or noxious trades, however, are of wider scope than might be inferred from the foregoing statement. They include also the drying of blood, tallow melting, bone degreasing, gut scraping, fellmongering, tanning, and similar processes. Over and above conditions peculiar to each process, it is the foul air that is usually responsible for the greatest nuisance. Even when the volume of foul air is not particularly great, it may be extremely offensive. For burning this air it was formerly necessary to instal specially-designed furnaces, which had to be controlled within narrow margins and under expert supervision. Subsequent developments introduced chlorine as an effective means of deodorising condenser air, even when that air was at its worst, thanks to the precise nature of the raw material which was under treatment. Nevertheless, there still remained the problem of destroying some of the offensive effluvia which result from manufacturing operations, and were it not for constant alertness in connection with trades likely to become offensive, we might well find ourselves back under conditions almost comparable with the year when the first general inquiry was set on foot.

The fact that dissemination of scientific knowledge brought improvement in the state of affairs exsting in 1875 needs a little emphasis in present-day circumstances. While it is sometimes difficult to avoid the tendency of a process to give rise to offensive vapours or effluents, the improving of conditions does not end with adopting means for avoiding public nuisance in the neighbourhood of the works; those employed at the works also demand due consideration. It is true that the health interests of personnel in general are watched over by various regulations which are enforced when the need arises, yet the owners of works may still find ways for improving still further the conditions under which employees are working. Here again, it is not always the administration side of the works which is wholly at fault for any lack of detailed attention to this matter; there is often genuine absence of knowledge as to how a works may be improved to offer real amenities to the employees.

In the first place, focussing attention upon a process likely to give nuisance or annoyance from its obnoxious nature, it must be fully realised that many raw materials of organic nature are liable to putrefy rapidly unless means are taken to avoid this; yet such means may not be favourable to the ultimate course of processing. In these circumstances much can be done towards the betterment of existing conditions by seeing that any such raw material as delivered to the works is in its best or "freshest" condition, even though necessarily a "waste," not otherwise usable and essentially discarded because of liability to offensive putrefaction. At the same time the accommodation provided at the works for reception of this material must be proper and convenient, works routine being so organised that accumulations can be worked up with due expedition or promptness. Furthermore, it is essential to see that the capacity of the plant installed is adequate to deal with the amount of raw material arriving at the works, within safe limits of storage under conditions which will not create a nuisance. That is the first thing to be done to make conditions better for those who are employed within the works.

Although a man may find it convenient, for the purpose of livelihood, to engage in work which the majority of others would consider highly distasteful, it should not follow that the employer can rest content in the knowledge that he has people to operate his processes, and that nothing need be done (on his part) to make that employment more congenial and cleaner and safer, over and above such provisions as are enforceable by law. If lack of knowledge of existing conditions is pleaded, it is no excuse; for all owners of works should be fully conversant with environment as well as with the exact nature of the processes which are operated.

FUEL ECONOMY

In a circular letter to industrial concerns the Minister of Fuel, Mr. Emmanuel Shinwell, states: "Stocks of coal held by power stations, gas works and industrial undertakings are substantially lower than they were this time last year. I am making every effort to increase the output of coal but there is a danger that next winter industrial production will be seriously curtailed.

"A new effort to save fuel and power is essential if this danger is to be averted. War-time experience showed that extraordinary savings were made when the management instituted and wholeheartedly encouraged a fuel watchers' system. With changes in staff and production your fuel watching may have lost its effectiveness, and I believe that the best chance of making the necessary savings quickly is to revive that enthusiasm."

A CHEMIST'S BOOKSHELF

SYSTEMATIC INORGANIC CHEMISTRY OF THE FIFTH-AND-SIXTH-GROUP NONMETALLIC ELEMENTS. By D. M. Yost and H. Russell. Oxford University Press. Pp. 423. 21s.

Some chemists tend to take up the quite unjustified attitude that inorganic chemistry, apart from the frills and trimmings, has been complete for a number of years, and that the existing books dealing with this branch will continue to be up-to-date to the end of time. In actual truth, of course, many new facts are yearly added to the literature of inorganic chemistry. And, even more important, many new ways of co-ordinating the knowledge which has been amassed are discovered, while just as many undoubtedly remain to be discovered.

As a consequence, while books which deal with modern aspects of inorganic chemistry tend to discuss "chapters" of topical interest, there is still room for books which will cover the systematic field in the light of new theories. Such a book is this one, which takes a small section of the periodic system and deals with it comprehensively.

The selection of elements by the authors would seem to be rather arbitrary. Although the title refers to the non-metallic elements of the fifth and sixth groups, investigation shows that of Group V elements only nitrogen and phosphorus are considered. The elements oxygen, sulphur, selenium, and tellurium represent Group VI more adequately. Arguing from the inclusion of the last of these elements, it seems rather in the nature of hair-splitting to exclude arsenic and antimony; and, to be frank, consideration of the nitrogen sub-group as a whole would have been very welcome.

This is all the more so since the treatment accorded to the six elements dealt with is first-rate. There can be practically no chemist, interested in theoretical aspects of these elements at any level, who will not find the book valuable.

In the preface, the authors outline their aim concisely, and claim that "the factual material chosen for presentation has been selected as critically as possible, and the sources are the original literature or the results of the authors' own researches. . . . In the topics presented in the book the reader will find many problems worthy of the serious attention of research workers in both pure and applied chemistry. Further, the advanced student should gain from the topics discussed a feeling for the present state of knowledge, and an appreciation of what has been accomplished in the past and what may reasonably be expected of the future." On reading the book, one realises that this is a fair statement, not only of the aims, but of the achievement.

Facts are presented critically, a method which is so often missing in comprehensive text-books of this nature. The reader is left convinced that the critical faculties directing the selection are competent. The arrangement of the matter is clear, and references to the literature are many. No feeling of uncertainty prevents the authors from stating where they consider that any item of research, or, indeed, any generally accepted "fact," is unsurely based or has little foundation. Basic reactions, preparations, and properties are fully and clearly detailed. The results of modern research on the structures of the molecules of the various compounds are summarised and frequently illustrated by diagrams.

There is, perhaps, bearing in mind the inorganic chemist, too great a predilection for thermodynamical data. This preponderance is undoubtedly derived from the research activities of the authors. Perhaps this is a good thing, however, since it at least brings home to the reader the interdependence, nowadays, of all branches of chemistry. It will also, undoubtedly, be of great value for the research worker, both in the industrial field and in the region of reaction mechanics.

If one minor criticism of the book might be voiced, it is that there is often more information given than is readily apparent. Thus, for example, nitrides are not to be found in the index, but on reading the sections on nitrogen one finds a reasonable amount of information on the metallic nitrides. On leaving the book—which will, however, be returned to again and again as a valuable work of reference—the reviewer's principal regret is that the authors have followed the recipe of Mr. Weller, writing so that their readers will "vish there vas more." As already indicated, even three more elements would have been warmly received. But how pleasant it would be to feel that for about fifteen guineas (using the present rate for calculation) one might possess a comparable treatment of all the elements in the periodic system.

CECIL M. WILSON.

ENTERPRISE FIRST. By William Wallace. London: Longmans Green. Pp. 112. 8s. 6d.

Mr. William Wallace, who is a director of Rowntree's, has written a book which will annoy extremists of every political shade but will interest all who are seriously concerned about the future of British industry. During the 1914-18 war he had a taste of Government as a temporary civil servant and throughout the recent war was a director of the Ministry of Food. Mr. Wallace's career began with a "first" in Law and he holds the degree of Master of Commerce at London University. No one, therefore, can doubt his qualifications for discussing the "relationship of the State

to industry, with particular reference to private enterprise," although some of his friends may feel that he is too modest in the opening chapter, which stresses that he is writing in a purely personal capacity.

Stating boldly that Britain, "running true to form," is reasonably certain to evolve its "own particular middle-of-the-way solution," the author believes that it may not be very logical—"we may perhaps be suspicious if it were"—but the test will be the practical one: Will it work? He further believes that the problems of scarcity and surplus, balance of payment and exchange, etc., are too big in the post-war world to be tackled by unaided private enterprise; and that the "ordinary Briton demands a further phase of economic emancipation" in what Mr. Wallace's American namesake has termed the "Century of the Common Man."

An early chapter discusses the rôle of the permanent Civil Servant, who is, of course, precluded from taking part in public controversy. Whatever else Mr. Wallace's book may accomplish, it will put him greatly in the debt of this small but highly experienced body on whom the brunt of day-to-day Government at its highest level falls. Indeed, everyone who glibly criticises Whitehall should be compelled to read chapter III, which reveals how much the country owes to some 1400 men who—excluding the diplomatic and consular service—number less than one-third of one per cent. of State servants as a whole. Officially, this group has no politics; and its complete integrity is the envy of every other country in the world.

Yet, turning to the problems of industry, Mr. Wallace is equally clear that the Government machine is not adapted to the delegation of initiative and responsibility, which is the essence of successful management. In theory, a Minister may not delegate his responsibility at all, and in practice senior Civil Servants move from one job to another, frequently at short notice, "without the slightest regard to the technical knowledge required for the job or to the bearing of their previous experience on their qualifications for handling the new job."

It is the function of a Government department to carry out the instructions of Parliament, and a body appropriate to administer the law is not suited to manage industry, which constantly requires swift decisions made on the spur of the moment, not bound by regulation and precedent. Mr. Wallace shows, however, that the higher Civil Service in partnership with industrialists achieved remarkable results during the war, and instances the record of the Ministry of Food. Every day, supplies of every kind had to be available in hundreds of thousands of shops, distributed evenly among 44 millions of a rapidly changing population, in spite of the fall of countries of supply, the sinking of ships, the wholesale bombing, and the competing demands on transport of all other forms of war necessities.

How the lessons of war can best be applied to the needs of peace is discussed by the author, whose conclusions have gained weight in the twelve months since the book was written. His comments on trade unions and freedom also deserve attention in the light of "closed shop" developments. Mr. Wallace sets out some detailed proposals for achieving the sense of unity and teamwork so much needed in British industry to-day.

J.A.B.

Polyvinyl Butyral

Its Use in Laminated Safety Glass

THE use of polyvinyl butyral has almost entirely replaced that of cellulose acetate as an interlayer in the laminated safety glass now produced by the Triplex Safety Glass Co., Ltd., according to an announcement made by Sir Graham Cunningham, chairman and managing director of the company, at a press conference at the Waldorf Hotel, Aldwych, London, W.C.2, on Monday.

The new type of plastic interlayer not only renders glass capable of withstanding nearly three times the strain previously possible, it makes possible more thorough adhesion between the glass and itself. As polyvinyl butyral is purely synthetic and not a cellulose derivatve, its quality is more consistent and its physical properties can be controlled to give the maximum safety properties. Its capacity for absorbing moisture is very low and as there are no volatile constituents within the "sandwich" which might escape round the edge, edge-sealing has been rendered unnecessary. Roof exposure tests extending over a period of five years, both in this country and abroad, have shown none of the discoloration that was an unwelcome feature of earlier types of safety glass, and the loss of light transmission has been smaller than the eye could detect.

Practical proof of the validity of the claims advanced for the new glass was given by Dr. A. A. C. Waine, Ph.D., D.Sc., chief chemist of the company, whose demonstration included his jumping on to a stretched circle of polyvinyl butyral, and dropping a 1.68 lb. ball on to a sheet of the new glass from a height of 20 ft.

Argentina's imports of chemicals, pharmaceutical products, oils and paints increased from 13,638 metric tons in January to 19,903 metric tons in February, according to Argentine customs statistics.

Chemicals from Coal

Col. W. A. Bristow's Views

THE increasing importance of the production of oils and chemicals from coal was stressed by Col. Whiston A. Bristow, F.Inst.P., M.I.E.E., M.I.A.E., chairman and managing director of Low Temperature Carbonisation, Ltd., when he addressed the annual general meeting of the company recently.

In the course of his speech, he said: "I have been asked questions about the advent of atomic energy and how it may affect our industry. I think its use for industrial purposes will be with us before long, probably in the form of electrical power, though there is no present indication of its being able directly to supply the motive power for the motor-car, aeroplane, or ship.

"Oil and coal appear, as a result, to be approaching a crossroads. From being chiefly sources of heat and light, they are being directed more and more into use as raw materials for the chemical industry. The complex carbon compounds of which they are composed are being identified and separated for use individually or broken down into simpler chemical units or 'bricks' wherewith to build up the fascinating chemicals and plastics of the new age. In common with other research organisations, we have been working along these lines for some time past and we are quite confident that, in that art, carbonisation is already taking an important part. It appears inevitable that this country will turn more and more in that direction in order to make the maximum use of its increasingly valuable, but limited, coal resources for the expansion of the industries such as ours which are based upon hydrocarbons and their derivatives.

Improvement of Lubricants

"To give you an example, a potentially important aspect of hydrocarbon synthesis is the development of lubricating oils. At present these are derived mainly from petroleum by distillation and refining, and until recently coal has taken little part in their production. Modern lubricants are being vastly improved, however, by the addition of special chemicals and in many cases these are being derived from coal. It also appears likely that the not too distant future the hydrocarbon 'bricks' will be built up into synthetic lubricating oils, the structure of which is likely fundamentally to incorporate these same additives or their properties. Coal hydrocarbons and coal chemicals may, therefore, conjointly be concerned in furnishing a new section of the lubricating oil industry and we have already begun to play our part in such developments."

Earlier in his speech, Col. Bristow referred to the Government's coal nationalisation policy. He said: "The Government have already stated that they are desirous of taking measures to restrict the burning of raw coal, to encourage the use of smokeless fuel, to diminish atmospheric pollution, and to encourage the more scientific utilisation of coal in order to preserve the valuable oils and chemicals contained therein instead of burning them. It was for these very reasons that the 'Coalite' process of low temperature carbonisation was invented, and they were actually set out in the patent of 1906. For the first time in our history they have now become an important part of a national fuel programme, initiated and to be carried into effect by the Government; that is, we were 40 years ahead of the national realisation. The price of bituminous coal has risen so greatly that we cannot afford to burn it in the raw state. In 1927 it was so cheap and so plentiful that producers were only too glad to find means of burning it, but a very different state of affairs exists to-day with coking smalls at four to five times the price and in very short supply.

Increasing Demand

"The production of oils and chemicals from coal has become a much more important matter than it was 20 years ago, and the commercially disposable materials are more numerous and valuable. The greatly increased requirements of our plastics industry are already in excess of production and will become even more so. There are also other new industries and processes now coming into being which will increase still further the demand for the higher priced products. Within the past few days, for example, we have made a contract for the supply of one of our materials for an entirely new purpose and to the extent of nearly £20,000. We have, as a result of our own research work, evolved still further products of even greater value for which there is a ready market.

"It is more than ever important that our export trade should be maintained. It seems unlikely that we shall be able materially to expand our export trade in coal itself, especially as we do not now raise enough for our own requirements. We can, however, export the liquid products we extract from coal and have already established a very satisfactory business. We ship to many countries in America, Europe, Asia, and Africa. We are even now constantly having to refuse substantial orders. We have sold every gallon we could make since we erected our first distillation plant in 1929."

Experiments in Coking Practice

Oven Types and Coke Properties

A REPORT, *Experiments on Coking Practice*, just issued by the Fuel Research Organisation of the D.S.I.R., and published by H.M. Stationery Office at the price of 4s., provides information of value to the coke-oven and metallurgical industries, particularly to those undertakings faced with the need to instal new batteries of ovens.

In the past, experience of the behaviour of coal coked in any particular battery of coke-ovens has generally been limited to coals or blends of coals drawn from an area adjacent to the battery. Shortly before the war, however, the Fuel Research Organisation of the D.S.I.R., in co-operation with the coke-oven and steel industries, began a comprehensive investigation of the carbonisation of different coals in commercial coke-ovens of several types operating under various conditions. The purpose of the investigation was to obtain precise information on the influence of the coal selected, the design of oven, and the methods of operation on the quantity and character of the coke produced, and the suitability of the coke for metallurgical purposes.

Owing to the war it was possible to complete tests with only three coals: from South Yorkshire, Durham, and South Wales: and of the six coke-oven installations, two were in Durham, and one each in Yorkshire, Lincolnshire, Scotland, and South Wales.

The ovens, which ranged in width from 12 to 21 inches and in capacity from 7 to 17 tons per charge, were operated under the control of the coke-oven managements in accordance with their experience; and complete records were made of the conditions of operation. Four of the ovens were of the vertical-flue regenerative type, one had horizontal flues, and one was a waste-heat oven

Special precautions were taken to ensure that the consignments of each coal to the several coke-ovens were of the same quality. The cokes obtained were examined not only by the usual physical and chemical tests, but also by X-ray crystallographic methods, and there were some tests with a small cupola to assess the cokes for foundry use.

It was not considered desirable to draw hard and fast conclusions from the limited experimental data available, but within the range of experimental conditions defined the following trends were noted. Increased rates of coking appear to reduce the size of coke and to reduce its strength. The coke from the narrowest oven was exceptionally large. The series of experiments indicates no orderly relation between width of oven or rate of heating on the one hand and coke abrasion indices or reactivity on the other. Coke reactivity appears to be governed more by the nature of the coal carbonised than by condition of coking.

In addition to tables and charts of results, the report includes a large number of photographs of samples of the cokes, and of sections specially prepared to provide information on their internal structure.

Scholarships in Metallurgy

Nuffield Travel and Research Scheme

A FELLOWSHIP scheme and two scholarship schemes designed to advance research, teaching, and training in extraction metallurgy have been established by the Nuffield Foundation. The scheme is in three parts:

(a) Five Travelling Fellowships are being offered each year to members of the teaching staff of universities and approved schools of mines and metallurgy within the Commonwealth and Empire. The aim of this scheme is to enable teachers to visit important mining and metallurgical centres in the Empire in the long vacation in order to study the methods employed in those centres. The value of each fellowship will be up to £500, including the cost of travel. The duration of each fellowship will be approximately three months.

(b) Five Travelling Post-graduate Scholarships are being offered each year for junior members of the profession who are graduates of universities and approved schools of mining and metallurgy in the Commonwealth and Empire and who have specialised in extraction metallurgy. Candidates will be selected not necessarily on account of their order of merit in examinations, but with regard also to their personality and general suitability. The value of a scholarship will be up to £500, including the cost of travel. The duration of a scholarship will not usually exceed six months.

(c) Ten Vacation Scholarships for students of mining and metallurgy at universities and approved schools of mines and metallurgy within the Commonwealth and Empire, to enable them to travel by air to important mining and metallurgical centres for vacation work. The value of a scholarship will be up to £200 to cover the cost of air travel.

The scheme has been drawn up in co-operation with the Institution of Mining and Metallurgy, which will continue to assist the foundation in the operation of the scheme. Full particulars, and forms of application for scholarships, may be obtained from the Secretary, Nuffield Foundation, 12/13 Mecklenburgh Square, London, W.C.1.

Personal Notes

MR. E. G. GOUGH has been appointed a director of Thomas de la Rue & Co., Ltd.

MR. A. V. LILLY has succeeded Mr. A. A. Houghton as chief chemist to Fredk. Boehm, Ltd.

DR. E. GREGORY, M.Sc., F.R.I.C., and BRIGADIER A. LEVESLEY, O.B.E., have been appointed directors of Edgar Allen & Co., Ltd.

ALDERMAN HENRY WILKINSON, who is service manager to Lever Brothers, Ltd., Port Sunlight, has been invited to become Mayor of Bebington, Cheshire, next year.

MR. W. D. RAE, B.Sc., A.R.I.C., chief research chemist to the Andre Rubber Co., Ltd., has been awarded his Ph.D., his thesis being "Some studies in the bonding of rubber to metal."

MR. S. C. DIGGORY, who has retired from the service of Monsanto Chemicals, Ltd., after being with the company and its predecessors since 1914, is well known in the chemical trade in Scotland and the North of England.

MR. W. W. STEVENSON, F.R.I.C., who has been appointed chief metallurgist to Dorman Long & Co., Ltd., has been assistant director of the research and development department of United Steel Companies, Ltd.

PROFESSOR C. H. LANDER, C.B.E., D.Sc., is retiring from the Chair of Mechanical Engineering in the University of London (City and Guilds of London Institute) at the end of this month, and will be succeeded by DR. O. A. SAUNDERS, D.Sc.

DR. E. CHAIN, who shared the Nobel chemistry award of 1945 with Fleming and Florey, is to be technical chief of a factory producing penicillin at Hälsingborg, Sweden, which is co-operating, in its manufacture, with Danish chemical interests.

The following departmental chiefs of Low Temperature Carbonisation, Ltd., have been appointed to the board: MR. F. L. WARING, works superintendent; MR. J. P. POSTLETHWAITE, chief engineer; and MR. J. H. STEPHENS, head of the sales organisation.

MAJOR P. G. ROBERTS, M.P., who has joined the board of Newton Chambers & Co., Ltd., is managing director of the Wombwell Main Colliery and a director of the Barnsley District Coking Co., Ltd., also of the Midlands steel and engineering firm of Wellman, Smith, Owen & Co., Ltd.

DR. W. H. DOW, president and chairman of the Dow Chemical Company, and president of the Ethyl Dow Chemical Company, has been awarded the Chemical Industry Medal of America for 1946. Presentation of the medal will be made in New York on November 8.

PROFESSOR J. L. SIMONSEN, Director of Colonial Products Research, and PROFESSOR SIR IAN HEILBRON, Professor of Organic Chemistry, Imperial College, left Britain by air on September 15 for a short visit to East and Central Africa. They hope to confer with scientists and other experts about the increased utilisation of Colonial raw materials and the organisation of research on the subject. They will also pay a short visit to the Union of South Africa, at the invitation of the Union Government.

Obituary

SIR JAMES HOPWOOD JEANS, O.M., F.R.S., died at his home at Dorking, Surrey, on September 16, five days after his 69th birthday. Though chemistry cannot claim him as a disciple, his work on stellar physics, which he approached from the mathematical side, has been of vital importance to the fundamental study of science as a whole. Of perhaps even greater importance to mankind in general was the rare faculty of exposition, possessed by Jeans to the full, by which means he was able to give the man-in-the-street some conception of what physics really means. Sir James Jeans was elected F.R.S. in 1906, and served as a secretary of the Royal Society in 1919-29; he was knighted in 1928.

International Congress

London Meetings Next Year

WHEN the 10th International Congress of Pure and Applied Chemistry was held in Rome in May, 1938, it was decided that the 11th Congress should be held in London in 1941, concurrently with the celebration of the centenary of the foundation of the Chemical Society of London. By reason of the war, both the centenary celebrations of the Chemical Society and the 11th International Congress were postponed; it has now been decided that both events should take place in London in July, 1947.

The 11th International Congress of Pure and Applied Chemistry will meet in London, under the presidency of Lord Leverhulme, from July 16, 1947, to July 24, 1947, and it is hoped that delegates from many countries will be present. Further information may be obtained from the hon. organiser at the following address: The 11th International Congress of Pure and Applied Chemistry, 56 Victoria Street, London, S.W.1. (Tel.: VICtoria 5216).

General News—From Week to Week

International postal reply coupons are again interchangeable in Italy and Germany, and can be obtained from the larger post offices in the U.K.

About 100 tons of copper will be required for the campaign stars now being struck at the rate of 15,000 a day at the Royal Mint and Woolwich Arsenal.

The price of refined platinum has been increased by a further 50s. to £23 5s. per troy oz., making a total rise, since the beginning of July, of £6 5s., or 37 per cent.

The Geological Museum, South Kensington, which was closed throughout the war, opened on September 18 with an exhibition illustrating the war work of geologists.

Work has started on the new £125,000 Beecham Group Factory at St. Helens, which is expected to be completed towards the end of next year. It is hoped to employ an additional 400 hands to assist in the export drive.

A new power plant costing £500,000 is being built by Dorman Long and Co., Ltd., of Middlesbrough, at their Cleveland works in Yorkshire. Construction has also begun at the works of a new central ore unloading and ore preparation plant for the whole group at a cost of £1,250,000.

Traces of oil at a depth of 4920 ft. have been found at Gringley, near Doncaster, by engineers of the Anglo-American Oil Company, after six months of boring. Coal measures were also revealed by the drills, and tests are now being carried out to determine the commercial possibilities of the oil.

After 80 years, Reads, Ltd., of Liverpool, are leaving 21 Bridgewater Street for new offices at Orrell House, Orrell Lane, Liverpool, 9, to which all communications should now be addressed. (Tel. Aintree 3600.) The company has received a licence to construct a new factory adjacent to its two existing plants at Orrell Park, so enabling them to increase the manufacture of their range of tins and drums and to centralise their plant.

Benn Brothers, Ltd., publishers of THE CHEMICAL AGE, are opening an office in Buenos Aires in November as part of the firms contribution to the country's export drive. Mr. Bryan French, hitherto manager of the inquiry department of *The British Trade Journal and Export World* (also published by Benn Brothers, Ltd.), will be in charge of the office and will be able to provide British manufacturers with first-hand information about current trading conditions and market possibilities for their products in the Argentine.

The Industrial Group of the Manchester Statistical Society, whose first meeting of the session is announced under the Forthcoming Events heading this week, exists to promote the knowledge and use of statistics in industry. Speakers include representatives of the chemical, steel, textile, and engineering industries.

In view of the very great dearth in London of the special accommodation required for rubber storage, some cargoes of rubber due to arrive shortly are being diverted to other ports, such as Liverpool. This will not involve any additional strain on inland transport, as the Midlands area consumes large quantities of rubber.

More than five hundred firms interested in industrial design will be represented at the conference to be held at the Central Hall, Westminster, London, S.W.1, on September 26 and 27, under the joint auspices of the Council of Industrial Design and the Federation of British Industries. This conference is the first of a series in conjunction with the "Britain Can Make it" Exhibition, and the importance of industrial design, notably in relation to Britain's export trade, will be stressed by speakers of authority.

Foreign News

Experiments with DDT are reported to be taking place in forestry stations in the U.S. zone of Korea.

Platinum is now quoted in the U.S. at $90 an ounce, according to *American Metal Market*.

Discussions as to the fate of the Japanese iron and steel industry are still proceeding, and although certain preliminary dismantling of plant against reparations account has been authorised, the final level of capacity and production has still to be agreed upon.

Four industrial scientists of the Monsanto Chemical Company have been granted leave of absence on full pay, for the purpose of spending a year of academic study at universities of their choice—a new move in American industry towards closer liaison between industry and the university laboratory.

The Smithsonian Institution in Washington celebrated the 100th anniversary of its inauguration last month. James Smithson, the founder, who left £100,000 to the U.S.A. "for the increase and diffusion of knowledge," was an Englishman of republican views, but never visited the United States. He was a distinguished chemist and mineralogist, but most of his original scientific papers perished in a fire at the Institution in 1865.

The title of the well-known American journal, *Chemical and Metallurgical Engineering*, was changed to *Chemical Engineering* with the August issue.

The sulphur refinery at Keciboriu, Turkey, is expected to be enlarged this year. At present sulphur production in Turkey does not meet domestic needs.

The centenary was celebrated, on September 7, of the inauguration of the iron works at Choindez, in the Swiss Jura, owned by the Ludwig von Roll'sche Eisenwerke A.G.

The Fabrique d'Engrais Chimiques, Fribourg, is paying an unchanged gross dividend of 7.14 per cent. on the share capital of 135,000 francs, equal to 5 per cent. net.

The first post-war trade fair in Prague was opened on September 15 by Dr. H. Ripka, Minister of Foreign Trade. It includes exhibits from nine foreign governments, and among private firms, three British, two Canadian, and one Swedish are exhibiting.

The Netherlands Government expects to import chemicals to the value of $14 million from the U.S. in 1946, part of a total of industrial imports amounting to $250 million. The imports are being financed partly by loans, partly by the realisation of recently unfrozen Dutch assets in the U.S.

A banquet dedicated to the promotion of the aims of UNESCO was held in Chicago on Friday last week, sponsored by the U.S. National Chemical Exposition (held at the Chicago Coliseum, September 10-14). The after-dinner subject for discussion was "The Rôle of Science in Building World Peace."

Forthcoming Events

September 21. Royal Institute of Chemistry (London and S.E. Counties Section). Oak Restaurant, 18 Kensington High Street, W.8. 7-11 p.m. Social dance in aid of benevolent fund.

September 23-28. Welsh Industries Fair. Drill Hall, Cardiff, 11 a.m.-6 p.m.

September 25 and 26. British Ceramic Society (Refractory Materials Section). Royal Sanitary Institute, 90 Buckingham Palace Road, London, S.W.1. Autumn meetings. Sept. 25: 10.15 a.m., business, followed by joint discussion with Building Materials Section; 12.30, lunch; 2.30 p.m., papers. Sept. 26: 10 a.m., papers.

September 25 and 26. British Ceramic Society (Building Materials Section). Royal Sanitary Institute, 90 Buckingham Palace Road, London, S.W.1. Autumn meetings. Sept. 25: 10.15 a.m., business, followed by joint discussion with Refractory Materials Section; 12.30, lunch; 2.30 p.m., discussion; 4 p.m., paper. Sept. 26: visit to Stewartby works of London Brick Co., Ltd., 9.25 a.m. train from St. Pancras.

September 26-27. Council of Industrial Design and Federation of British Industries. Central Hall, Westminster, London, 10 a.m.

September 26. Royal Statistical Society. (Sheffield Group). Royal Victoria Station, Hotel, Sheffield, 6.30 p.m. Mr. A. W. Swan: "What Statistics Can Do in Industry that Other Methods Cannot Do."

September 26. Imperial Institute. Cinema Hall, Imperial Institute, South Kensington, London, S.W.7, 3 p.m. Mr. S. Bracewell: "The Geology and Mineral Resources of British Guiana."

September 26. Oil and Colour Chemists' Association (London Section). Royal Society of Tropical Medicine and Hygiene, 26 Portland Place, London, W.1, 6.30 p.m. Mr. G. T. Bray: "Drying Oils and Oil Seeds in the British Empire."

September 27. Manchester Statistical Society (Industrial Group). College of Technology, Sackville Street, Manchester 6.30 p.m. Mr. Dennis Newman: "Sampling Inspection: Statistical Considerations."

October 2. Institution of Works and Factory Managers (Midland branch). Queen's Hotel, Birmingham, 7 p.m. Mr. C. R. Jordan: "The Different Problems Arising in the Management of Small and Large Factories."

October 3. Oil and Colour Chemists Association (London Section). Royal Institution, 21 Albemarle Street, London, W.1, 6.30 p.m. Professor H. W. Melville: "The Chemistry of High Polymers—I."

October 3. The Chemical Society. Burlington House, Piccadilly, London, W.1, 7.30 p.m. Mr. J. M. Robertson and Mr. J. G. White: "The Crystal Structure of Pyrene: A Quantitative X-Ray Investigation;" Mr. R. F. Barrow, Mr. C. J. Danby, Mr. J. G. Davond, Mr. C. N. Hinchelwood and Mr. L. A. K. Staveley: "The Re-distribution and Desorption of Adsorbed Gases."

October 7. Society of Chemical Industry (London Section). Chemical Society's rooms, Burlington House, Piccadilly, London, W.1, 6.30 p.m. Dr. W. H. J. Vernon: "Chemical Research and Corrosion Control: Some Recent Contributions of a Corrosion Research Group."

Company News

The nominal capital of **Germstroyd Products, Ltd.,** chemical manufacturers and dealers in germicidal liquids, etc., 47 Great Russell Street, W.C.1, has been increased beyond the registered capital of £8000 by the addition of £12,000, in £1 shares.

The nominal capital of **Tennants (Lancashire), Ltd.**, chemical merchants, etc., Manchester, has been increased beyond the registered capital of £30,000 by the addition of £5000. The additional capital is divided into 500 5 per cent. cumulative preference shares of £1 and 18,000 ordinary shares of 5s.

Beecham Maclean Holdings, Ltd., has issued details of a plan to redeem the 1,096,176 outstanding 5 per cent. redeemable cumulative preference shares and the 466.943 outstanding 5½ per cent. redeemable cumulative preference shares on October 14 at 21s. 6d. per share together with a sum equivalent to the dividend (less tax) accrued to that date. The redemption will be financed by an issue to existing holders of these classes of preference shares of 1,563,119 4 per cent. redeemable cumulative preference shares of £1 each at 21s. per share, of which holders of shares of either class may take up one new share for each existing preference share now held.

In a circular issued by **Genatosan, Ltd.**, ordinary shareholders of the company are offered conversion, on a share for share basis, into 10s. ordinary shares of a new company — Genatosan Trust — and shareholders of the new company are invited to dispose of all or part of their holdings to Fisons, Ltd., at 12s. 6d. per share. The new company's share capital is at present £1000 in 2000 shares of 10s., but as soon as the offer by it has become unconditional, its share capital will be increased to £1,000,000, divided into 2,000,000 ordinary shares of 10s. It is intended that, in due course, the new company should create and issue for cash up to £1,000,000 of preference shares.

Chemical and Allied Stocks and Shares

PARTLY owing to the better tendency on Wall Street, stock markets have rallied, and firmer conditions developed, moderate gains predominating in most sections. British Funds displayed further strength, repayment of 2½ per cent. National Defence Bonds leading to re-investment demand; 2½ per cent. Consols again rose higher, and there were all-round gains in Savings Bonds and National War Bonds. The volume of business in industrials was again moderate, international uncertainties making for caution, but good features were not lacking, and elsewhere leading oil shares showed general improvement. Spectacular gains were recorded in foreign railway stocks on the important developments affecting British-owned railways in the Argentine and Brazil.

Imperial Chemical strengthened to 43s. and there was a sharp rally in Dunlop Rubber to 74s. Turner & Newall firmed up to 85s. 3d., while United Molasses 53s. 3d., British Oxygen 97s. 6d., and Borax Consolidated 46s. became firmer. The units of the Distillers Co. rallied to 134s., while among other shares of companies with plastics interests De La Rue moved up to £12⅞ on suggestions that the £1 shares may be "split" into four of 5s. each. British Industrial Plastics were firm at 8s. 3d. and Erinoid 5s. ordinary 15s. 9d. The market is talking of a new issue by the latter company, which, it is being assumed, may take the form of an offer of additional shares to shareholders. British Aluminium were 42s. 9d., and although little changed in price, Imperial Smelting at 19s. 7½d. and Amalgamated Metal at 19s. 3d. became firmer. British Drug Houses were 53s. 9d., Fisons 60s. 6d., W. J. Bush 90s., and Cooper McDougall 40s. 6d. Plaster Products 5s. shares rose to 14s. 6d. in anticipation of an interim dividend, British Plaster Board 5s. ordinary firmed up to 33s. 9d. and Associated Cement to 66s. 9d.

Iron and steel shares showed firmness with small gains predominating, although there is continued talk that a bill may be contemplated to give the Government powers to acquire share interests in iron and steel companies. Guest Keen, after an earlier decline, have rallied strongly to 41s. 9d. Allied Ironfounders were 59s. and Lambert Bros. shares jumped strongly to 82s. 9d. on the increased distribution. Staveley were 52s. 10½d., United Steel 26s., Whitehead Iron 87s. 6d., Shipley 38s., Powell Duffryn 24s. 1½d., and Dorman Long 26s. 9d. Among electrical equipments, Associated Electrical rose to 69s. 6d. on the maiden interim dividend which has encouraged hopes that the total payment for the year may be raised from 10 per cent. to 12½ per cent. On the other hand, following news of the terms of the new issue, Johnson & Phillips encountered profit-taking and receded 2s. to 83s. English Electric showed firmness at 62s. and General Electric were 98s. 6d., but there was a sharp fall to 8s. 3d. in Brush Electrical 5s. shares on fears of a dividend "cut."

Boots Drug, after strengthening, eased slightly to 61s. 3d. Griffiths Hughes were 61s. 6d. and Beechams deferred rallied to 26s. 4½d. Paint shares strengthened on the higher prices announced by manufacturers; Pinchin Johnson were 43s. 3d., Goodlass Wall 28s. 6d., and International Paint rose to £6¾, the last-mentioned also being helped by the higher interim dividend. Triplex Glass eased to 40s. 3d. awaiting the dividend announcement. Lever & Unilever improved to 52s., Greeff-Chemicals Holdings 5s. shares were 12s. 9d. and Monsanto Chemicals 5¼ per cent. preference 23s. 9d. Among oils, Shell improved to 93s. 9d., Burmah to 70s. and Anglo-Iranian to 99s. 4½.

Prices of British Chemical Products

DELIVERIES of the chief lines of heavy chemicals during the past week have been maintained on a good scale and a fair amount of inquiry for new business has been reported from the London market. With few, if any, exceptions, prices continue strong. Among the potash chemicals the B.P. and technical grades of permanganate of potash are moving well, while the demand for bichromate of potash and yellow prussiate of potash continues to be in excess of available supplies. Steady deliveries of formaldehyde are being taken at unchanged rates and a steady demand is reported for arsenic, salammoniac, and hydrogen peroxide. In the acid section, oxalic acid continues in strong request and all grades of acetic acid are in good call. A steady trade has been put through in the soda products section, with hyposulphite of soda in good demand. The coal-tar products market continues active and most items are well booked.

MANCHESTER.—Plenty of new business is offering in the alkalis and other leading heavy chemicals on the Manchester market and the past week's inquiries have included a fair number from shippers, though in respect of the latter there is continued difficulty in arranging even approximate shipment dates for several descriptions of chemicals. On the home market existing contracts are being drawn against satisfactorily and good quantities are going forward to the textile and allied trades, as well as to other leading outlets. In several sections of the fertiliser market, notably in the phosphatics and in lime, fair buying interest is reported.

GLASGOW.—A steady volume of business has been observed passing in the Scottish heavy chemical market during the past week. Orders continue to be strong and supplies weak, and there are considerable delays in the delivery of all classes of material. The export market has also been busy with inquiries and orders, but here again various factors affect the delivery of most materials. Prices in most cases continue to rise.

Price Changes

Rises: Ammonium phosphate; ammonium sulphate; lead nitrate; lead, red; lead, white; linseed oil.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton, £47 10s.; 80% pure, 1 ton, £49 10s.; commercial glacial, 1 ton, £59; delivered buyers' premises in returnable barrels, £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r. MANCHESTER: £16 to £16 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER: £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—MANCHESTER: £40 per ton d/d.

Ammonium Carbonate.—£42 per ton d/d in 5 cwt. casks. MANCHESTER: Powder, £43 d/d.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £19 10s. per ton. See also Salammoniac.

Ammonium Persulphate.—MANCHESTER: £5 per cwt. d/d.

Antimony Oxide.—£120 to £123 per ton.

Arsenic.—Per ton, 99/100%, £26 10s. for 20-ton lots, £31 for 2 to 10-ton lots; 98/99%, £25 for 20-ton lots, £29 10s. for 2 to 10-ton lots; 96/99% white, £21 15s. for 20-ton lots, £25 15s. for 2 to 10-ton lots.

Barium Carbonate.—Precip., 4-ton lots, £19 per ton d/d; 2-ton lots, £19 5s. per ton. bag packing, ex works.

Barium Chloride.—98/100% prime white crystals, 4-ton lots, £19 10s. per ton, bag packing, ex works.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £18 15s. per ton d/d; 2-ton lots, £19 10s. per ton.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax.—Per ton for ton lots, in free 1-cwt. bags, carriage paid: Commercial, granulated, £30; crystals, £31; powdered, £31 10s.; extra fine powder, £32 10s. B.P., crystals, £39; powdered, £39 10s.; extra fine, £40 10s. Borax glass, per ton in free 1-cwt. waterproof paper-lined bags, for home trade only, carriage paid: lump, £77; powdered, £78.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial,

granulated, £52; crystals, £53; powdered, £54; extra fine powder, £56. B.P., crystals, £61; powder, £62; extra fine, £64.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£22 to £24 per ton, ex wharf. Granulated, supplies scarce.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5⅝d. per lb.

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Carbonate.—MANCHESTER: £8 15s. per cwt. d/d.

Copper Oxide.—Black, powdered, about 1s. 4½d. per lb.

Copper Sulphate.—£33 10s. per ton, f.o.b., less 2%, in 2 cwt. bags.

Cream of Tartar.—100 per cent., per cwt., from £13 17s. 6d. for 10-cwt. lots to £14 1s. per cwt. lots, d/d. Less than 1 cwt., 2s. 5½d. to 2s. 7½d. per lb. d/d.

Formaldehyde.—£27 to £28 10s. per ton in casks, according to quantity, d/d. MANCHESTER: £28.

Formic Acid.—85%, £54 per ton for ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1260 s.g., in tins, £4 to £5 per cwt., according to quantity; in drums, £3 19s. 6d. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—11d. per lb. d/d, carboys extra and returnable.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d. per lb., according to quantity.

Lactic Acid.—Pale tech., £60 per ton; dark tech., £53 per ton ex works; barrels returnable.

Lead Acetate.—White, 70s. to 75s. per cwt., according to quantity.

Lead Nitrate.—About £70 per ton d/d in casks. MANCHESTER: £68.

Lead, Red.—Basic prices per ton: Genuine dry red lead, £71; orange lead, £83. Ground in oil; Red, £92; orange, £104. Ready-mixed lead paint: Red, £99; orange, £111.

Lead, White.—Dry English, in 8-cwt. casks, £83 per ton. Ground in oil, English, in 5-cwt. casks, £102 per ton.

Litharge.—£68 10s. to £71 per ton, according to quantity.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £36 per ton.

Magnesium Chloride.—Solid (ex wharf), £27 10s. per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., for 2-cwt lots, 9s. 1d.; smaller quantities dearer.

Mercurous Chloride.—10s. 1d. to 10s. 7d. per lb., according to quantity.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 3s. per gal.; pyridinised 64° O.P 100 gal., 3s. 1d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£100 to £105 per ton in ton lots packed in free 5-cwt. casks. MANCHESTER: £5 per cwt.

Paraffin Wax.—Nominal.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £76 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate. — Crystals and granular, 7⅞d. per lb.; ground, 8⅞d. per lb., for not less than 6 cwt.; 1-cwt. lots, ½d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £57 per ton for 5-ton lots, £57 10s. per ton for 1 to 5-ton lots, all ex store; hydrated, £51 per ton for 5-ton lots, £51 10s. for 1 to 5-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 8½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8d. per lb.; technical, £7 14s. 3d. to £8 6s. 3d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Salicylic Acid.—MANCHESTER: 1s. 8d. to 2s. 1d. per lb. d/d.

Soda, Caustic. — Solid 76/77%; spot, £16 7s. 6d. per ton d/d.

Sodium Acetate.—£42 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 6½d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite. — Powder, 60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£36 to £45 per ton, nominal.

Sodium Hyposulphite.—Pea crystals 19s. per cwt. (ton lots); commercial, 1-ton lots, £17 per ton carriage paid. Packing free.

Sodium Iodide.—B.P., for not less than 28 lb., 10s. 2d. per lb.

Sodium Metaphosphate (Calgon).—11d. per lb. d/d.

Sodium Metasilicate.—£16 10s. per ton, d/d U.K. in ton lots.

Sodium Nitrite.—£22 10s. per ton.

Sodium Percarbonate.—12½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £25 per ton d/d for ton lots. Tri-sodium, £27 10s. per ton d/d for ton lots (crystalline).

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salt).—£5 5s. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. MANCHESTER: £4 12s. 6d. to £4 15s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot, £20 2s. 6d. per ton, d/d, in drums; crystals, 30/32%, £13 7s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £20 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £14 5s. to £16 10s., according to fineness.

Sulphuric Acid.—168° Tw., £6 2s. 8d. to £7 2s. 8d. per ton; 140° Tw., arsenic-free, £4 11s. per ton; 140° Tw., arsenious, £4 3s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—Per cwt., for 10 cwt. or more, £15 8s.; 5 to 10 cwt., £15 9s. 6d.; 2 to 5 cwt., £15 11s.; 1 to 2 cwt., £15 13s. Less than 1 cwt., 3s. 1d. to 3s. 3d. per lb. d/d, according to quantity.

Tin Oxide.—1 cwt. lots d/d £25 10s.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d; white seal, £54 5s.; green seal, £53 5s.; red seal, £51 15s.

Zinc Sulphate.—Tech., £25 per ton, carriage paid.

Rubber Chemicals

Antimony Sulphide.—Golden, 1s. 8½d. to 2s. 7½d. per lb. Crimson, 2s. 7½d. to 3s. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 8s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£37 to £41 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£44 to £49 per ton, according to quantity.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 10 5/16d. to 1s. 5¾d. per lb.; dark, 10½d. to 1s. per lb.

Lithopone.—30%, £28 2s. 6d. per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Phosphate.—Imported material, 11% nitrogen, 48% phosphoric acid, per ton in 6-ton lots, d/d farmer's nearest station, in September, £19 17s., rising by 2s. 6d. per ton per month to March, 1947.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, in September, £9 14s., rising by 1s. 6d. per ton per month to March, 1947.

Calcium Cyanamide.—Nominal; supplies very scanty

Concentrated Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. No. 1 grade, where available, £14 18s. 6d.

"Nitro Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £17 5s. per ton; granulated, over 98%, £16 per ton.

Coal Tar Products

Benzol.—Per gal. ex works: 90's, 2s. 6d.; pure, 2s. 8½d.; nitration grade, 2s. 10½d.

Carbolic Acid.—Crystals, 11½d. per lb. Crude, 60's, 4s. 3d. MANCHESTER: Crystals, 9½d. to 11½d. per lb., d/d; crude, 4s. 3d., naked, at works.

Creosote.—Home trade, 5¾d. to 8d. per gal., according to quality, f.o.r. maker's works. MANCHESTER, 6½d. to 9¾d. per gal.

Cresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. MANCHESTER: Pale, 99/100%, 4s. 4d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £7 2s. 6d. to £10 per ton, according to m.p.; hot-pressed, £11 10s to £12 10s. per ton, in bulk ex works; purified crystals, £25 15s. to £28 15s per ton. Controlled prices.

Pitch.—Medium, soft, home trade, 75s. per ton f.o.r. suppliers' works; export trade, 120s. per ton f.o.b. suppliers' port. MANCHESTER: 77s. 6d. f.o.r.

Pyridine.—90/140°, 18s. per gal; 90/160°, 14s. MANCHESTER: 14s. 6d. to 18s. 6d. per gal.

Toluol.—Pure, 3s. 1d. per gal.; 90's, 2s. 4d. per gal. MANCHESTER: Pure, 3s. 1d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 3½d. to 3s. 6d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £21 per ton; grey, £25. MANCHESTER: Grey, £25 per ton.

Methyl Acetone.—40/50%, £56 per ton.

Wood Creosote.—Unrefined, about 2s. per gal., according to boiling range.

Wood Naphtha, Miscible.—4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. per gal.

Wood Tar.—£5 per ton.

Intermediates and Dyes (Prices Nominal)

***m*-Cresol** 98/100%.—Nominal.

***o*-Cresol** 30/31° C.—Nominal.

***p*-Cresol** 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb; 66/68° C., 1s.

***p*-Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

***o*-Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

***p*-Toluidine.**—2s. 2d. per lb., in casks.

***m*-Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON.—September 18.—For the period ending Sept. 28 (October 12 for refined oils), per ton, naked, ex mill, works or refinery, and subject to additional charges according to package: LINSEED OIL, crude, £135. RAPESEED OIL, crude, £91. COTTONSEED OIL, crude, £52 2s. 6d.; washed, £55 5s.; refined edible, £57; refined deodorised, £58. COCONUT OIL, crude, £49; refined deodorised £56; refined hardened deodorised, £60. PALM KERNEL OIL, crude, £48 10s.; refined deodorised, £56; refined hardened deodorised, £60. PALM OIL (per ton c.i.f.), in returnable casks, £42 5s.; in drums on loan, £41 15s.; in bulk £40 15s. GROUNDNUT OIL, crude, £56 10s.; refined deodorised, £58; refined hardened deodorised, £62. WHALE OIL, refined hardened, 42 deg., £89; refined hardened, 46/48 deg., £90. ACID OILS: Groundnut, £40; soya, £38; coconut and palm-kernel, £43 10s. ROSIN: Wood, 32s. to 45s.; gum, 44s. to 54s. per cwt., ex store, according to grade. TURPENTINE, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Treatment of aluminium, etc.—D. H. Napier, J. V. Westwood, and United Anodising, Ltd. 24670.

Titanium pigments.—National Titanium Pigments, Ltd., J. T. Richmond, and R. J. Wigginton. 24456.

Crotonic acid derivatives. — Organon Laboratories, Ltd., and W. C. J. Ross. 24205.

Treatment of plastic materials.—Pilkington Bros., Ltd., J. E. Wilcock, and G. H. Baillie. 24040.

Glyceride mixtures.—Procter & Gamble Co. 24055.

Desulphurisation processes.—P. W. Reynolds, D. M. Grudgings, and I.C.I., Ltd. 24131.

Alcohols. — P. W. Reynolds, D. M. Grudgings, and I.C.I., Ltd. 24453.

Adhesives.—Shawinigan Chemicals, Ltd. 24524.

Alkaline washing agents.—Soc. des Produits Peroxydes. 24687.

Synthetic oils, etc.—Solar Manufacturing Corporation. 24472.

Glycollic acid derivatives.—A. W. C. Taylor, J. G. M. Bremner, R. R. Coats, and I.C.I., Ltd. 24450.

Pesticidal compositions.—J. Taylor, J. M. Holm, and I.C.I., Ltd. 24123.

Insecticides.—D. W A. Wells. 24602.

Copolymers. — Wingfoot Corporation. 24410, 24411, 24415.

Rubber latex.—Wingfoot Corporation. 24412.

Esters.—Wingfoot Corporation. 24413.

Nitriles.—Wingfoot Corporation. 24414

Aluminium, etc., welding.—Almin, Ltd., and H. G. Warrington. 24916.

Resinous material.—American Cyanamid Co. 25416.

Carbon disulphide.—C. Arnold (Standard Oil Development Co.). 24814.

Hydrocarbons.—C. Arnold (Standard Oil Development Co.). 24815, 25300, 25302-4.

Alkylation processes.—J. C. Arnold (Standard Oil Development Co.). 24813.

Hydrocarbons.—J. C. Arnold (Standard Oil Development Co.). 24816, 25301, 25306.

Oxygen production.—J. C. Arnold (Standard Oil Production Co.). 25299.

Acid dyestuffs.—S. G. Bedekar and K. Venkataraman. 25409.

Anthraquinone.—S. G. Bedekar and K. Venkataraman. 25410.

Interpolymers. L. Berger & Sons, Ltd., W. T. C. Hammond, and L. E. Wakeford. 25066.

Organic sulphides.—G. W. J. Bradley. 25020.

Treatment of cellulose products.—British Celanese, Ltd. (Celanese Corporation of America). 24946.

Vinylfluorines.—British Thomson-Houston Co., Ltd. 25392.

Dyestuffs.—S. Coffey, D. A. Fairweather, and I.C.I., Ltd. 25196.

Dyestuffs.—S. Coffey, D. A. W. Fairweather, D. E. Hathway, and I.C.I., Ltd. 25197.

Complete Specifications Open to Public Inspection

Catalytic treatment of oils of any origin with a view to obtaining various hydrocarbons.—D. Balachowsky. July 7, 1943. 22796/46.

Concentration of organic substances.—Distillation Products, Inc. February 23, 1945. 992/46.

Curing of polymeric materials.—E. I. du Pont de Nemours & Co. February 22, 1945. 5598/46.

Production of olefinic carboxylic acids.—E. I. du Pont de Nemours & Co. February 23, 1945. 5599/46.

Manufacture of commercial polyvinylic alcohol products and the obtained products.—E. Fiorillo and A. Polgar. October 16, 1942. 15673/46.

Polymerisation of vinyl ethers.—General Aniline & Film Corporaton. February 21, 1945. 5061/46.

Production of azo dyestuff images from N-acyl-N-aryl hydrazine developers.—General Aniline & Film Corporation. February 24, 1945. 5871/46.

Photographic sensitisers and process of sensitising silver halide emulsions. Gevaert Photo-Producten N. V. February 26, 1945. 5049/46.

Vinyl halides and process of preparing the same.—B. F. Goodrich Co. November 9, 1944. 27806/45.

Spinning of yarns of acrylonitrile polymers.—Imperial Chemical Industries, Ltd. July 28, 1943. 14432-3/44.

Aqueous emulsions of waxes.—Imperial Chemical Industries, Ltd. February 21, 1945. 5444/46.

Pulverising and drying of granular materials.—International Pulverising Corporation. February 22, 1945. 2405/46.

Organic mercury compounds and process for preparing the same.—R. A. Lehman. February 16, 1945. 11207/46.

Chemical compounds and processes of preparing the same.—Merck & Co., Inc. February 22, 1945. 1884/46.

Complete Specifications Accepted

Production of glycerine and fatty esters from animal and vegetable fats and oils.—National Oil Products Co. Nov. 3, 1942. 579,767.

Manufacture of degradation products of starch and adhesives. — S. Neumann. June 28, 1944. 579,702.

Manufacture of detergent compositions.—Pennsylvania Salt Manufacturing Co. Dec 4, 1942. 579,835.

Alkylation of aromatic hydrocarbons.—Shell Development Co. Nov. 2, 1942. 579,781.

Production of acrylic acid and its esters.—N. Short, and I.C.I., Ltd. Jan. 12, 1944. 579,855.

Process for the manufacture of thermosetting synthetic resins by the polymerisation of alkylene oxide derivatives.—De Trey Frères Soc. Anon. June 16, 1943. 579,698.

Process for lowering the olefin content of olefin-containing hydrocarbon fractions.—Universal Oil Products Co. Aug. 24, 1942. 579,827.

Process of treating sulphidic tungsten ore concentrates.—T. J. Williams. Nov. 13, 1942. 579,743.

Grain or shaped articles of a-alumina. November 3, 1944. 580,031.

Production of iron or steel alloys containing vanadium and silicon.—Climax Molybdenum Co. March 6, 1941. 579,923.

Production of ferrous alloys containing cobalt and silicon.—Climax Molybdenum Co. March 6, 1941. 579,924.

Production of ferrous alloys containing chromium and silicon.—Climax Molybdenum Co. March 6, 1941. 579,925.

Production of ferrous alloys containing titanium and silicon.—Climax Molybdenum Co. March 6, 1941. 579,926.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

BOUVERIE HOUSE, 154 FLEET STREET, LONDON, E.C.4

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1422. September 28, 1946 Annual Subscription 21s. Overseas 26s.

Large-Scale Research

RESEARCH in the abstract is a pleasing subject. Research in the laboratory, where everything is well under control, is commonly an exact subject. Research on the large scale, where the investigator is at the mercy of conditions, is prone to be exasperating. It is only when the research man comes to investigate large-scale operations that he finds how very unsatisfactory the best-laid schemes may be in practice. Mathematically, problems become more difficult as the number of variables increases, and it does not require many variables before they become what mathematicians delight in calling "intractable." *Divide et impera* is a good rule in science as in war; but not infrequently it is impossible to divide problems into their components, and this is particularly true of large-scale problems.

An example of the difficulty of drawing conclusions from large-scale work is afforded by the latest D.S.I.R. publication connected with Fuel Research entitled: "Experiments on Coking Practice." The research was planned in a manner that would seem admirable to those without experience of large-scale investigations in by-product coking. A number of coals was selected for the purpose. On account of the outbreak of war in 1939, the full programme could not be carried out, and only three of these coals were used. The full programme on these coals, however, appears to have been fulfilled. They were a Durham coking coal, a South Yorkshire coal from the Parkgate seam, and a South Wales coking coal. From these coals there was prepared a bulk washed and crushed "sample" sufficiently large to enable three complete ovens to be charged at each of six coking plants. The six plants possessed ovens of widely different design. That in itself would at one time have provoked considerable caution, because every oven-builder used to claim that his design was the best, and produced the best coke. Perhaps it is fair to accept to-day the view that every coke oven produces equally good coke when charged with the same coal; *perhaps* that is reasonable, but when to this factor are added different lengths of time since the ovens were built, different handling, and the idiosyncrasies of different operators, it becomes a large assumption to believe that every one of these six plants, scattered all over the country from Scotland to South Wales, would be in equally good fettle. In point of fact the authors of the report show clearly that there were such variations, and that not every oven was equally perfect.

On Other Pages

Then let us mark the character of the ovens. In this we shall neglect the type of oven (which should not affect the problem if we accept our initial assumption) and concentrate on operating conditions. Given in order, we shall state (a) the mean width, (b) the mean height, and (c) the approximate mean operating flue temperature (in degrees Centigrade) 10 min. after reversal.

	(a)	(b)	(c)
Oven A	20¾"	6' 10⅝"	1150°
Oven B	17¾"	13' 9½"	1100°
Oven C	18"	11' 7"	1150°
Oven D	16"	12' 6"	1260°
Oven E	14"	11' 8"	1275°
Oven F	12"	11' 6"	1075°
Intermittent vertical retorts	11"	16' 8"	1150°

It will immediately be seen that several variables are added to the list. The ovens are of widely different widths. Simultaneously, they are operated at widely different temperatures. Simultaneously also, they are of very different heights, involving different pressures on the coking mass, and probably different compressions due to the heights dropped by the coal when charging. There may have been other simultaneous variables due to these causes or to other causes; such, for example, as different distribution of temperature due to differences in the method of regulation of the gas or to the height of the coal charge.

By this time, the reader may ask what was the purpose of the research. The answer is that it did not appear to have any clearly defined purpose. We read in the report that " as a first step . . . . intended to serve as a guide in planning further investigations," it was decided "to determine the yields and properties of the cokes obtained by carbonising six coals in six types of industrial coke ovens of different width and in an intermittent vertical chamber oven." Not unnaturally, the results were almost entirely negative. The report states that " owing to the fact that the series of experiments was not completed and the data available refer to only three coals, no definite conclusions have been drawn from the results." The reason why no definite conclusions have been drawn, and in our view cannot be drawn (other than confirmation of known facts), is that there were too many simultaneous variables. This is not the place to discuss the results in detail, and we shall refer only to this research as an outstanding proof that in large-scale work, as in the laboratory, the principle of *divide et impera* must be followed. If it is decided to investigate the effect of oven width upon shatter index, for example, there should be no other variable than oven width. If the temperature is to be varied, again there must be only that one variable. It will be admitted at once that research of this character is very expensive indeed since it means in effect building a battery of ovens specially for the test—a wholly uneconomic proceeding. It would not seem impossible, however, for arrangements to be made to reduce at any given time all variables but one to so small an amount as to enable them to be neglected.

When all is done, however, we must ask whether such experiments on by-product coke ovens are of very much value. Again and again in this report the conclusion is reached that the nature of the coal is of more consequence than the carbonising conditions. That is undeniable and suggests that the first variable to be considered is that of the nature of the coal. It would be a comparatively reasonable undertaking, with the backing of Government funds, to build a small battery of six or more ovens of different widths, and capable of being heated as desired to different flue temperatures, and to investigate in them the behaviour of many different coals. In that way it would be possible to determine which oven width and temperature would produce from coals of various characters the best kind of coke for particular purposes. The cokes produced might be tested in large-scale practice. Large-scale research is full of difficulties, difficulties which often arise from economic causes. Sometimes there is a short cut to success. Sometimes there is no short cut. When this happens, as appears to have happened with this attempt at coke-oven research, it is necessary to determine whether the information to be obtained from the research is worth the money that must be expended upon it. Our own view is that a much more modest programme can be drawn up, capable of being carried into effect with far less expenditure and without the need for building a full battery of coke ovens. The conclusions that are drawn from the modest experiments can then be tried out on the full manufacturing scale. But at least let us have no more attempts to draw conclusions from experiments carried out in the face of more dependent variables than can be handled.

NOTES AND COMMENTS

"Atomic" Raw Materials

PROFESSOR M. L. OLIPHANT, of Birmingham University, whose remarks about atomic energy have embodied a good deal more common sense than those of most speakers, was extremely frank when he enlarged on the subject at a meeting of the Liberal Party Council in London on Wednesday last week. Declaring that there was no protection against the atomic bomb, he advocated the control of the essential raw materials as the most hopeful way of approaching the problem. There was no uranium in Britain, he pointed out, and precious little in the United States; in fact, America, from the point of view of raw materials, was unimportant. It was therefore not surprising that when the United States advocated the control of raw materials, other nations should be suspicious. As for the use of atomic energy for industrial purposes, he believed that Russia would solve the engineering and metallurgical problems involved sooner than Britain, and America sooner than either country. He was quite firm in averring that not only was there no protection from an atomic bomb which would probably be fired from a distance, but there was no cure for persons who had been affected by the resultant radiation. In our view, Dr. Oliphant is extremely sound in his refusal to shilly-shally over this problem. International control of some sort—preferably, it would appear, of the raw materials concerned—is the only reasonable method of dealing with the greatest potential danger that has ever threatened civilisation.

Uranium in France

REPORTS have been appearing intermittently in the French daily Press announcing the discovery of deposits of uranium ore in one or another part of France. It is a fact, says *L'Industrie Chimique* (1946, No. 349, p. 149) that certain secondary radioactive ores—formerly examined as possible sources of radium—have been re-examined to assess their uranium content, but no sensational discovery has been made. Actual radioactive mineral deposits of limited extent are widely distributed in the "Massif Central," the mountainous core of Central France, notably in the Morvan and the Monts du Forez. In the former locality a deposit near Autun has given name to the mineral autunite, a phospho-uranite of calcium ($CaO.2UO_3.P_2O_5.8H_2O$), while in other veins the presence of torbernite or chalcolite, a copper compound of similar nature ($Cu.2UO_3.P_2O_5.12H_2O$) has been detected, and in certain instances, round about 1930, some of these deposits were actually worked for radium or uranium, the ore from one of the Morvan mines being despatched to the Baccarat glassworks. Recent prospecting has located other sources farther to the south and west. It is now believed, however, that these may merely be outcroppings of a subterranean mass of primary radioactive ores, of the character of pitchblende, hidden within the heart of the Massif Central; and it is suggested that the extraction of these is a problem worthy of the attention of French mining engineers. A search of the geological literature indicates that both of the secondary ores mentioned occur also in Saxony and Cornwall, while autunite has been reported from various places in the U.S., and torbernite from Czechoslovakia.

Advice on Research

THE appointment of a new chairman to the Advisory Council for Scientific and Industrial Research, as recorded in our "Personal Notes" seems an appropriate occasion for some reference to the functions of that august and influential body, especially since, in the 30 years since the D.S.I.R. was established there have been three chairmen only. Sir William McCormick, F.R.S., held the appointment from 1916 to 1930. He was neither a scientist nor an industrialist, but a Professor of Arts at a Scottish university, with a flair for administration and "getting things done." He was followed by Lord Rutherford of Nelson, F.R.S., the great scientist. On his death in 1937, Lord Riverdale of Sheffield, an iron and steel industrialist, became chairman and has held the appointment until now. The Advisory Council occupies a most important position in the organisation of the D.S.I.R. Its duties are to advise the Lord President of the Council on all research activities of the Department. The Council is composed of men who have an expert knowledge of science or of industry and labour. The members serve in a personal capacity and not as representatives of any organisation. Each member brings his own particular knowledge to the meetings of the Council so that every aspect of a problem can be

adequately studied. In consequence the composition of the Council is such that it makes an effective link between Government, Industry, and Science. It was probably the first example of a body of people, outside the Government, formed to advise on policy for implementation inside the Government. The main task of planning the post-war developments of the D.S.I.R. fell on the Council under Lord Riverdale. Most of the research Stations are being expanded and three new organisations have been or are being established. Increased financial support for the industrial co-operative research associations, for individual fundamental research workers, and for students have been made after careful inquiries. Special committees deal with grants to research associations, as well as to individuals, to assist them in fundamental research, and with maintenance allowances to students to enable them to be trained as research workers.

Britain *Can* Make It

AFTER taking a preliminary look round the exhibition which the King opened in the Victoria and Albert Museum, London, on Tuesday, we are left in no doubt that Britain *can* make it—and by " it " we mean almost the entire range of consumer goods. A whole year's work has gone into the preparation of this exhibition and although, when the idea was first mooted, it was received with a certain amount of lukewarmness, for it was felt that the time was not ripe for such a large-scale affair, industry generally has given magnificent support, as is shown by the fact that the selected exhibits total not far short of 6000 and come from more than 1300 firms. Dominating everything is a sense of reaction from the severity and enforced simplicity of design in wartime. By this it is not implied that there is any tendency towards vulgarity or over-decoration, but there is plenty of evidence of a healthy regard for freshness and colour. While the exhibition is not a trade fair and is primarily intended to demonstrate the meaning of first-class standards in design, there is little doubt that its effect on the country's export trade will be wholly beneficial. Not only is the exhibition admirably arranged, the goods themselves are presented in a manner that reflects nothing but credit on all concerned. The exhibition is certainly worth a visit, whether by consumer or producer.

The Importance of Quality

IN his opening speech, the King drew a parallel between this, the first post-war exhibition to be arranged and staged by one of the fighting nations, with that other pioneer exhibition, opened only a few hundred yards away by his great-grandfather, the Prince Consort, in 1851. Then, as now, one of the main objectives was the improvement of design. Indeed, the insistence on design has been the keynote of the publicity concerning the present venture, chief sponsor of which is the Council of Industrial Design. At the risk of being likened to Cassandra, we would here utter a faint note of warning. Design is a very important thing in itself, but it is not the whole story. Quality and workmanship are at least as vital. No one knows that better than the industrial chemist, who is usually more concerned with raw materials than with finished products; and no industry has suffered more in the past from the application of the wrong raw materials to otherwise excellent design than has the plastics industry. It was probably a mere coincidence that the B.B.C. chose Tuesday night to reconstruct and examine the Tay Bridge Disaster. So far as we know, the *design* of the old Tay Bridge has not been impugned; the disaster would appear to have been caused by dishonest workmanship and slovenly administration. So, however excellent a design may be, we must not forget to look beneath the surface.

MELDOLA MEDAL

The award of the Meldola Medal, which has been suspended since 1941, is to be resumed this year. The Society of Maccabæans, in whose gift the medal is, will present the medal to the chemist who, being a British subject and under 30 years of age on December 31, 1946, shows the most promise, as indicated by published chemical work brought to the notice of the Council of the Royal Institute of Chemistry before December 31, 1946. No restrictions are placed on the kind of chemical work or the place in which it is conducted; and the merits of the work may be brought to the attention of the Council either by persons who desire to recommend the candidate or by the candidate himself. Letters of recommendation should be addressed to: The President, Royal Institute of Chemistry, 30 Russell Square, London, W.C.1, the envelope being marked "Meldola Medal." The award will be decided in January, 1947.

Wool Wax Alcohols

Their Properties and Utilisation in Industry

In view of the increasing attention that is being paid to the industrial importance of wool wax, the appearance of a booklet* on the subject, collecting and correlating as much as possible of the published and unpublished literature on the subject, is most timely. In the following paragraphs, stress is laid particularly on some of the industrial applications of the component alcohols of wool wax, as indicated by Mr. Lower; the booklet itself contains full details from the chemical and technological, as well as from the industrial point of view.

The first plant for the continuous production of wool wax alcohols was laid down in this country in 1936. Previously the sources of supply had been Germany, America, and Holland, although the Dutch product, being a distillation material, was somewhat different in appearance from the others, and probably did not represent the alcohols as they are originally present in the raw material—wool grease.

The basic material from which these alcohols are prepared is either raw wool grease (acid-cracked or otherwise) or refined wool grease (wool wax, lanolin), a higher yield of alcohols resulting when the latter product is used. The grade of wool grease known as centrifuged neutral wool grease is also well known as a good source of the alcohols. This grease contains less free acidity than the "acid-cracked" wool greases, but slightly more than is contained in the refined product (lanolin). Raw wool grease is obtained from the sheep's wool by washing with alkalis, soaps, suint and/or newer detergents such as sulphonated alcohols. It contains combined and free alcohols, combined and naturally occurring free fatty acids, and also free fatty acids obtained from the wool washing liquors. Traces of sulphur, metals, moisture, and dirt are also present.

A True Wax

Neutral wool grease, or lanolin, is now established as a true wax, not a fat, and Lewkowitsch actually proposed the term "wool wax" for this portion of wool grease many years ago, but the name did not seem to meet with a ready response in the trade at the time. It will be clear from this that the alcoholic constituents are, therefore, wax alcohols. Polyhydric alcohols are absent, although a dihydric alcohol, lanyl alcohol, has now been isolated. There is anything up to 7 per cent. of free alcohols in wool grease, especially the centrifuged grades, with approximately 50 per cent. total alcoholic components (free and combined).

The actual and potential uses of this alcohol mixture seem to be enormous. It would appear to be a most promising material for production of fine chemicals such as cholesterol, "steroidal" hormones, vitamin-D precursors, etc., and at the same time is being widely used as an anti-corrosive coating composition in textile dressings, and ointment bases. These alcohols are the subject of a monograph in the Sixth Addendum (1943) to the B.P. 1932, under the title of "Wool Alcohols" (*Alcoholia Lanæ*).

The question of the alcohols which are the actual components of the wool wax alcoholic complex yet remains to be answered in full, and a search of the literature shows the doubts and contradictory statements that exist on the subject. However, certain alcohols have been definitely isolated and identified, and these fall into three series: sterols, triterpene alcohols, and aliphatic alcohols.

Sterols

Only two true sterols have so far been certainly isolated from the mixed alcohols, these being cholesterol and cholestanol. Although it is known often to accompany naturally occurring cholesterol, there is nothing yet to indicate the presence in the wool wax alcohols of the chemical derivative of cholesterol, 7-dehydrocholesterol, the precursor of vitamin D_3. Up to 1937, the presence of minute quantities of ergosterol was regarded as not unlikely, though this too awaits confirmation, while the earlier belief that the so-called "metacholesterol," "oxycholesterol," and "*iso*cholesterol" formed part of the complex does not find support in recent work.

Two cholesterol-rich fractions obtained from wool wax alcohols are now offered by Croda, Ltd., on the British market. The first, "Kathro" cholesterol, is a white amorphous powder, M.P. 110°C., $(a)_D = -27.2°$ in choroform, iodine value 53.5 per cent., cholesterol 70-72 per cent., agnosterol and lanosterol 2.5 per cent., optically inactive (aliphatic, etc.) alcohols about 25-30 per cent. This product is completely soluble in the following solvents at about 20°C., solutions being prepared by warming; amyl formate, cyclohexanol and its acetate, cyclohexanone, chloroform, dipentene, decahydronaphthalene, methyl abietate, octyl alcohol, oleic acid, rosin spirit, tetrahydronaphthalene, and xylol. It is substantially soluble in amyl alcohol and acetate, benzyl alcohol, carbon disulphide,

* *Wool Wax Alcohols in Industry*, by E. S. Lower, technical director of Croda, Ltd. Published by Croda, Ltd., Croda House, Snaith, Goole, Yorkshire.

carbon tetrachloride, cyclohexylamine, hexyl alcohol, methyl cyclohexanol, and light mineral oil. Its emulsifying power is equal to and even slightly better than that of pure cholesterol.

The other fraction, "Dastar" cholesterol, is an off-white to cream-coloured powder, $(a)_D = -18.0°$ in chloroform, iodine value 38.8, cholesterol 50 per cent., agnosterol and lanesterol about 5 per cent., optically in active alcohols, etc., 45 per cent. This material has slightly better emulsifying ability than the former grade of cholesterol.

Applications of Cholesterol

Among industrial applications of cholesterol may be mentioned its use in the production of suspensions of titanium pigments, for instance, in thermoplastic materials such as are employed for paper impregnation to render these impermeable to liquids and gases, *e.g.*, waxes or resins. The function of the cholesterol in such a process is to aid wetting of the pigment by the waxes, etc., and for this purpose 0.01 to 1 per cent. is the quantity used. Cholesterol is mentioned as a suitable material for addition, in quantities up to 5 per cent., to condensation products of phenolformaldehyde with the purpose of eliminating high pressures and temperatures employed in the manufacture of these products; also the elimination of " pores " is claimed.

A process has been protected for incorporating irradiated cholesterol in soap, in an attempt to impart either anti-rachitic properties to the soap, or the beneficial dermatological properties that are possessed by or accompany, the anti-rachitic principle. The larger outlet, however, is the use of this sterol as a superfatting agent. Various mixtures also have been suggested, consisting, for instance, of cholesterol and cholesteryl laurate and stearate, or the sterol and cetyl alcohol, or white wax. Cholesteryl esters may be useful in producing germicidal soaps, tending to increase the absorption of curative agents. Even small traces of cholesterol, it is maintained, enhance the cosmetic effect of toilet soaps. Cholesterol in an emulsified form easily penetrates the epidermis and imparts suppleness of the dermis. A specific example of a superfatting mixture consists of, approximately, cholesterol 5 per cent., lanolin 8 per cent., cetyl alcohol 14 per cent. An excess of cholesterol, incidentally, reduces the lathering power of soap to a greater extent than does lanolin.

Cholesterol-polyethylene glycol esters, obtained by reaction of cholesterol with ethylene oxide in an autoclave at about 120-140°C. have been protected, and products of this nature are described as having special properties of importance to the textile industry, particularly as dispersing agents for organic dyestuffs and basic dyestuffs. A process for rendering waterproof cellulose or cellulose derivatives containing wool or other textile materials employs, to this end, aliphatic *iso*cyanates, and among the latter is mentioned cholesteryl-adipic acid ester *iso*cyanate (in benzene). Wool muslin is treated with this solution, followed by removal of solvent and exposure to a temperature of 140°C. for two minutes. The textiles react superficially with the water repellents.

Substances for addition to cleansing, wetting out, foaming, dispersing, etc., baths in the textile and leather industries have been obtained in the form of sulphonated ethers or esters, of *e.g.*, cholesterol, and a polyhydric alcohol containing one or more monoesterified acid radicals of boron or phosphorus. A recent American article suggests that the use of cholesterol materials in the textile industry over there is assuming importance. Among their uses are mentioned emulsion stabilisation and valuable lubricating, washing, dyeing and finishing properties. A proprietary article which has been made available is stated to consist of "especially treated cholesterol and sterols, far exceeding individual sterols in surface activity." The product is a semi-solid, non-volatile oil, completely soluble in most oils. Specific applications include its use for stabilising oil-in-water emulsions, and the ability to disperse, stabilise, solubilise, and promote even penetratation of practically all types of dyes. The products have also been developed for stabilising printing pastes and emulsions, resulting in clear, sharp, uniform prints. It is conceivable that simple mixtures of cholesterol-rich fractions of wool wax alcohols and white mineral oils might react similarly.

The last reference to the uses of cholesterol deals with the manufacture of vitamin D_3—the anti-rachitic vitamin—or the manufacture of the precursors of vitamin D_3. Ordinary cholesterol, purified simply by re-crystallisation, may be anti-rachitically activated by exposure to the action of the cathode rays of a high-voltage cathode-ray tube. Cholesterol, or cholesterol-containing substances, are rendered pro-vitamin-containing by oxidation with non-gaseous oxidising agents of the type of hydrogen peroxide, benzoyl peroxide, eosin, and chromic anhydride. In another example, cholesterol is enriched in pro-vitamin D_3 by heating the sterol with solid benzoyl peroxide between 120° and 250°C.

Triterpene Alcohols

It is now known that the so-called "*iso*-cholesterol" fraction of wool wax alcohols is, in fact, a mixture of two unsaturated alcohols, lanosterol and agnosterol, classed as triterpene alcohols or resinols. They have thirty carbon atoms and a picene skeleton, consisting of five six-membered rings.

On dehydrogenation they yield picene and substituted naphthalenes.

This mixture of alcohols has been produced on a commercial scale from careful fractionation of the total unsaponifiable matter of wool grease, by distillation with the aid of superheated steam or other gas, giving 40 per cent. yield with products of oxidation. It has been obtained in the form of a pure white solid. It consists of 0-20 per cent. agnosterol plus 80-100 per cent. lanosterol, and is insoluble in methyl alcohol. As an emulsifying agent it has no special qualities, and has even been described as showing antipathy towards emulsifying, and insolubility in petroleum. Wool wax alcohols from which this binary mixture has been removed are said to have increased emulsifying properties.

It was soon observed that agnosterol was not always to be found as a constituent of wool wax alcohols, and, for this reason, attention was directed to the possibility of its formation by the action of the caustic alkalis used in preparing these mixed alcohols, on the major constituent of the "*iso*-cholesterol" mixture, lanosterol, but this was found not feasible. The name lanosterol was originally prepared to identify the "*iso*cholesterol" product, being less misleading than the latter term; it was not then known that this product was a mixture.

Agnosterol

Agnosterol melts at 162°C., $(a)^{18}_{D} = +70.4°$, crystallising in needles from ethyl alcohol. Its molecular weight is given as 424 ($C_{30}H_{48}O$). It differs from lanosterol in that it has one reactive double bond and two inactive double bonds. Two of these bonds are conjugated. An agnosteryl derivative, dehydroagnosteryl acetate, has been prepared from lanosterol and found to be identical with the same acetate prepared from agnosterol. This supports the knowledge that agnosterol and lanosterol differ only in the number and position of their double linkages.

Six years after the original isolation of agnosterol, similarities which exist between this chemical and theelin, the natural follicular hormone, suggested agnosterol as a starting material for the synthesis of artificial œstrogenic substances, and, in fact, such products were actually produced, of high œstrogenic activity, in the form of yellowish, glassy, jelly-like gums. The process used was one of oxidation by means of chromic oxide. The resultant active agents are not, however, identified. Untreated agnosterol possessed no activity when tested similarly.

Lanosterol forms the greater part of the methanol-insoluble matter of wool wax alcohols, has a melting point 140-5°C., $(a)^{15}_{D} = +57.9°$ in chloroform. The molecular weight of this product is 426 ($C_{30}H_{50}O$). Its iodine value is 170.5 by Dam's method. This has proved very reliable for sterols, bromine being used as the reactant.

Lanosterol is apparently very susceptible to oxidation (giving a mixture of ketones, if chromic anhydride is used) and shows a marked tendency to resinification. It does not give the strong colour reactions characteristic of sterols. It shows absorption of ultra-violet light. Upon dehydrogenation with palladium charcoal, it gives a hydrocarbon $C_{18}H_{20}$. It is soluble in chloroform, more difficultly soluble in ethyl alcohol, acetone, ligroin, and very sparingly in methyl alcohol. At the moment, there is no published information to indicate the possible uses of lanosterol, except in combination with agnosterol and epinephrine from the treatment of asthma.

Aliphatic Alcohols

Only two alcohols have been identified out of the mixture that is left after the sterols and triterpene alcohols have been separated out, which can be partly accomplished by solution of the whole in acetone, from which the bulk of optically inactive alcohols separate. These two are new alcohols and have not been found elsewhere than in wool wax alcohols. They are lano-octadecyl, a monohydric alcohol of mol. wt. 270 ($C_{18}H_{38}O$), m.p. 42-43° C., and lanyl, a dihydric alcohol, mol. wt. 326 ($C_{21}H_{40}(OH)_2$), m.p. 78.5°C. Although this alcohol seems to be unsaturated it does not absorb bromine at room temperature.

There are other alcohols to be identified and (of these the most important would appear to be cetyl alcohol, mol. wt. 242 ($C_{26}H_{34}O$), m.p. 49°C., b.p. 190° at 15 mm., $D^{20}_{4} = 0.8105$, acetyl value 197. The remaining alcohols to which reference has been made in the literature seem, on recent work, to be themselves mixtures, their composition being still uncertain.

The uses of these types of alcohol are very well developed and include, of course, wetting agents, cosmetics, emulsifying agents, condensation products, lubricants, textile assistants, acetals, amides, esters, ethers, etc.

Mixed Wool Wax Alcohols

From the commercial point of view, really the most interesting product is the mixture of wool wax alcohols, offered by Croda, Ltd., usually in the form of small lumps or large blocks.

The alcohols are a yellow wax-like mixture, similar in many respects to beeswax, but more brittle. Warmed from, say, 5 to 65°C., the mass moves through the stages of a pliable mass to a very viscous liquid, which takes many hours to reset to its original state. These alcohols do not decompose under normal storage conditions.

It has been shown that cholesterol, the main constituent, has an inhibitory action against the decomposition of oils and fats in which it is dissolved, and similar properties have been attributed to these mixed wool wax alcohols.

Upon standing undisturbed for any great length of time, say six months, the alcohols set to a very tough mass and assume a mirror-like brightness due, no doubt, to surface oxidation and resinification. The depth of this resinified layer has been found not to exceed 1/16th of an inch after the storage over a period of four years. The free fatty acid content of the layer after this period had risen from 0.69 per cent. to 17 per cent. Means have been found of accelerating this modification with the object of using such derivatives as coating compositions. The mixture will not polish, but it breaks with a clean fracture.

General Composition

A general compositional analysis is as follows: cholesterol, 25.5 to 33.1 per cent., cholestanol (and other saturated sterols) 2.5 to 5.1 per cent.; agnosterol, 0 to 5.3 per cent., lanosterol 21.3 to 26.6 per cent.; optically inactive (aliphatic) alcohols, etc., 50.7 to 29.9 per cent.

In Table 1, an average analysis of "Hartolan" wool wax alcohols is given in column (1); the other two sets representing figures published for an American (2) and German (3) product are included for comparison purposes.

It will be seen that this mixture of alcoholic bodies differs in many ways from true waxes and wax-like materials on the market. Probably the most interesting feature, apart from the low acidity and saponifiable content, is the high, or comparatively high, melting point, taking for comparison spermaceti, cetyl alcohol, stearic acid, and some synthetic and mineral waxes.

TABLE I.

	(1)	(2)	(3)
Ash content	0.25%	0.02%	—
Acid value	1.8	2	1.5
Acetyl value	130	109	—
Cholesterol	32%	16.5%	—
Ester value	2.0	—	—
Iodine value (Wijs)	45.5	77	—
Melting point	60.5	57	57
Mean molecular weight ...	377	—	—
pH value	5.7	—	—
Specific optical rotation $(a)^{20}_{D}$ =	−11.8°	−0.6°	—
Saponification value	8	62	23
Unsaponifiable matter ...	97%	80%	—
Viscosity at 200° F. (Redwood No. 1)	216 sec.	—	—
Water-soluble matter ...	<1%	—	—

The solubility of wool wax alcohols in various solvents is reflected in the following observations on solutions (20 per cent. w/v), prepared hot and put on one side for a week at about 20 °C. using Hartolan wool wax alcohols:

(1) Complete solubility: carbon bisulphide and tetrachloride, chloroform, methyl cyclohexanal, rosin spirit, trichlorethylene, toluol.

(2) Very slight deposit found: amyl alcohol, benzol, cyclohexanol, decahydronaphthalene, dipentene, ethylene glycol mono-butyl ether, methylene dichloride, solvent naphtha, tetrahydronaphthalene, white spirit.

(3) Substantially insoluble; acetone, butyl alcohol, acetate, formate, lactate, and phthalate, acetal solvent, cyclohexanone, cyclohexanol acetate, diacetone alcohol, dibutyl phthalate, diethylene glycol mono-ethyl ether, ethyl ether, ethyl phthalate, ethyl acetate, ethyl lactate, ethylene glycol, mono-methyl ether and acetate, *iso*propyl alcohol and acetate, *iso*butyl alcohol, methyl ethyl ketone, methyl alcohol and acetate, petroleum ether.

One of the most important properties of wool wax alcohols is their power to emulsify and hold large quantities of water, forming emulsions of the water-in-oil type. Also, they can be diluted with oils, fats and even some solvents, for example, liquid paraffin, white oils, white spirit, or liquid fatty alcohols (oleyl) and the resultant mixtures and solutions used as emulsion bases, producing in turn water-in-oil emulsions when agitated with water. The use of kerosene for this purpose (in conjunction with lanolin) is the subject of a recent British patent, covering the product now sold under the trade name Furmament emulsifier.

Wool wax alcohols water-in-oil emulsions, when well prepared, are very stable in the presence of electrolytes, mild acids, metallic salts, etc., and do not go rancid.

Main Groups of Uses

The many uses of these alcohols can be divided into two main groups. The first contains the many applications of the alcohols as purchased, and without further treatment, *e.g.*, as true wax substitutes, or emulsifying agents, plasticisers, etc., while the second group contains the uses of the alcohols when treated to give valuable reaction products, *e.g.*, wetting agents or sterol derivatives. The majority of the subject matter is protected by patents or patent applications, and this publication cannot be held to give protection against action for infringement.

In one patented process, for the manufacture of concentrated aqueous dispersions of "waxes and rosin," the procedure consists of heating together a mixture of wax and rosin (19 : 1) in the presence of water, plus a calculated amount of alkali. This emulsion is of the oil-in-water type and is used for paper sizing, etc. Another oil-in-water emulsion of similar make-up, used for lubricants, polishes, waterproof paper, etc., consists of an emulsified mixture of neutral waxes and hydrocarbons of high melting-point, with one or more alcohols, including

wool wax alcohols, plus fatty or resin acids. A 2 per cent. sodium carbonate solution is used as the dispensing medium and up to six times the weight of the fatty bodies may be used.

Another process, for producing aqueous bituminous emulsions, employs 5 per cent. wool wax alcohols. Molten or liquid bituminous material and the alcohols were mixed together and hot water added. Another example employed wool wax alcohols and a fatty acid, plus alkali, prior to addition of the water.

It has been found that the properties and combustion of motor fluids, such as benzol, alcohol, crude oils, etc., are improved by the addition of wool wax alcohols. For example, pinking or knocking may be eliminated or reduced. For this process, wool wax alcohols of a bright yellow colour are to be preferred, since this is said to indicate the presence of unaltered colouring matter, lanaurin, probably related to bilirubin, which, in combination with the mixed sterol alcohols, appears to be of advantage in reducing the rate of fuel combustion. The preferred mixtures include petrol, 1 gal. plus 0.5 to 2.0 g. wool wax alcohols.

In a pigmented form or mixed with resins, other wax-like materials, pigments and solvents, these materials have been found to give ideal pastes for use between dissimilar metal jointings, to prevent electrolytic corrosion. Such mixtures also have been employed as jointing pastes for filling screw head holes in wood, etc., rust holes in metals, and as putty substitutes. Another important use is the fixing of lenses into optical or other lensed instruments, and their parts. Black pigments are most suitable for this last purpose.

Fat-Liquoring Tests

Experiments on the use of wool wax alcohols for fat-liquoring have been carried out, and, from a few preliminary tests, it was found that both saponifiable and mineral oils could be readily emulsified by the aid of these alcohols in the presence of a small quantity of soap. A convenient method for preparing the emulsions which could be used in ordinary tannery routine is as follows: Dissolve the wool wax alcohols in the oil to be saponified by gently warming together. Dissolve the soap in a convenient amount of warm water, and then pour the oil mixture into the soap solution. Moderate agitation produces a stable emulsion which can be further diluted if necessary.

The next step was to ascertain the relative proportions of the constituents to use, bearing in mind that in most tanneries the water used for fat-liquoring, although the minimum in volume, will usually contain some hardness. Five per cent. of wool wax alcohols on the weight of oil being emulsified was adopted as a suitable proportion.

A composition containing "Hartolan" wool wax alcohols has been prepared for investigations concerned with the determination of the effect of perspiration on shoe materials, and consists of 0.5 litres of the following solution:

Urea crystals	1 gram.
Lactic acid B.P.	5 ml.
10% aq. disodium phosphate	1 ml.
N. sodium chloride sol. ...	100 ml.
Distilled water added ...	500 ml.

gradually added to a molten mixture of:

"Hartolan" wool wax alcohols	20 g.
Butyric acid	5 ml.
Saturated alcoholic egg lecithin	10 ml.
Russian tallow	1 ml.

at 35° C., using a powerful whisk.

(To be continued)

German Technical Reports

Latest Publications

SOME of the latest technical reports from the Intelligence Committees in Germany are detailed below. Copies are obtainable from H.M. Stationery Office at the prices stated.

CIOS XXXII—124. *Items selected from the minutes of meetings of the I.G. Technische Ausschuss*: New acetylene chemistry; Zinc amalgam electrolytic process; Mersol as a fat-substitute product; Polyurethane; New developments of di-isocyanate chemistry; New things in acetylene and carbon monoxide chemistry (1s.).

BIOS 171. *Dr. Alexander Wacker Ges. für Elektrochemische Industrie, Burghausen*: Catalytic hydrogenation of acetylene to ethylene. (1s.)

BIOS 496. *Extraction of copper and other metals from pyrites cinder* (2s. 6d.).

BIOS 594. The *production and application in Germany of high-silicon acid-resisting iron* (3s 6d.).

BIOS 676. *German metallurgical laboratories for ferrous metals, with special reference to the K.W. Institute for Iron Research* (8s. 6d.).

BIOS 688 *Interview with Dr. Stecklin and Dr. Roolig, formerly of the Leverkusen Laboratories of I.G. Farben A.G.*: Merits of synthetic and natural rubbers and the compounding and processing of synthetic rubbers in tyre manufacture (6d.).

FIAT 213. *Summary of field investigations*: Fats, oils and oilseeds (2s. 6d.).

FIAT 364. *German fats, oils, and oilseed processing plants* (2s.).

FIAT 535. *Industrial X-ray field in Germany* (1s. 6d.).

FIAT 681. *The paint, varnish, and lacquer industry of Germany* (5s. 6d.).

"Britain Can Make It"

Exhibition Opened this Week

H.M. THE KING, accompanied by the Queen, opened the "Britain Can Make It" exhibition in the Victoria and Albert Museum, London, on Tuesday. The exhibition will remain open until a date between October 31 and November 23, according to attendance. As noted elsewhere in our columns, a request has been received from Scotland for the exhibition to be transferred there later.

Organised by the Council of Industrial Design, the exhibition covers almost the entire range of consumer goods and is selective, more than 5000 articles having been chosen by about twenty selection committees from a total of about 20,000 submissions. The exhibits demonstrate strikingly the rapid change-over from war to peace production in Great Britain, and show a new high level in design standards. The exhibition is not a trade fair, but there are numerous information kiosks at which home and overseas buyers may obtain particulars of goods in which they are interested.

Although there are no chemical exhibits as such, manufacturers and others in the industry will doubtless be interested in the plastics section of the materials group. This presents many of the latest applications of plastics, among the firms co-operating being I.C.I., Ltd.; Bakelite, Ltd.; De La Rue Plastics, Ltd.; BX Plastics, Ltd.; Holpolast, Ltd.; Thermo-Plastics, Ltd.; Tenaplas, Ltd.; Catalin, Ltd.; and Moulded Components (Jablo), Ltd.

Chemical Exports

Drop in Figures for August

AUGUST exports from the U.K. totalled £14.5 million less than the July record of £91.9 millions, mainly due to the general holiday, but in part to the steel shortage.

The Board of Trade monthly accounts for August show that exports of chemicals, drugs, dyes, and colours were valued at £5,827,448, which is £643,905 less than the July total, but £2,531,646 more than the figure for August last year and £3,970,799 above the monthly average for 1938. British India led the buyers with purchases totalling £932,008, followed by Australia (£387,199), and the Union of South Africa (£272,714). The quantity of finished dyestuffs (930 tons) was the highest on record and twice the monthly average of the best pre-war year.

Imports of chemicals, drugs, dyes, and colours into the U.K. during August showed an increase for the first time for several months. The total value is given as £1,536,852, which is £183,662 above the July figure; £340,624 above the figure for August last year; and £402,462 more than the monthly average for 1938. The U.S.A. was the largest supplier during August, with goods valued at £434,504; the Argentine Republic was second £170,260); and Palestine third (£153,928).

German Casein Plastics

Little Progress in War-Time

DIAGRAMS and illustrations of the most up-to-date machinery used in the German casein plastics industry are included in BIOS Final Report No. 282, together with translations of certain German patents on the subject. As noted in Mr. Dutton's article on p. 383, little progress appears to have been made by this industry in the past 15 years and, so far as the war period is concerned, manufacture of casein plastic articles practically ceased, due to a shortage of rennet casein. An exception was the International Galalith Co., who continued manufacture on a reduced scale until 1944.

This company uses an interesting extruder with a special nozzle, of which drawings are given in the report. Various configurations are described, including basket work pattern, star pattern, spot pattern, etc. To produce the star pattern, star configurated rods are extruded through a special nozzle and then packed in a standard block press box, in layers, in such a way that the rods are not bent and that each successive layer rests in the grooves of the preceding one. The mass of rods is then pressed cold, sufficient heat being preserved in the extruded rods to consolidate the casein. After removal from the press and cooling, the mass is placed on edge and after glueing to a base, is sliced into sheets.

The International Galalith Co. has three special machines which are used for grinding flat and round rods so that hexagonal, heptagonal and similarly shaped rods can be produced, suitable for the pen, pencil and allied trades. The speed of the wheels of these machines is 4500 r.p.m.

Drawings of an apparatus manufactured by Hermann Berstorff, Hannover, illustrate a special mixing nozzle developed for the International Galalith Co. No perforated plate is used in this design, the plastic being thoroughly homogenised by churning between a revolving toothed wheel plate and stationary wheel.

Mention is made of two processes designed to produce transparent effects. At one factory diphenylamine is the reagent used and at another a mixture of two parts of ethyl benzyl aniline to one part of dichlorhydrin is employed. A note is also given on an interesting development in the production of embossed sheet at the August Ehlhardt Söhn Works at Durach.

French Chemical Notes

Bigger Output of Fertilisers

DURING the war, numerous French plants producing fertilisers and agricultural chemical products were destroyed or seriously damaged, while many warehouses similarly disappeared from economic life. Before 1939, annual output of nitrogenous fertilisers in France absorbed 180,000 tons of nitrogen, or 15,000 tons a month, representing a tonnage of fertilisers of from four to five times this figure.

In August, 1944, output amounted to 3500 tons of nitrogen a month; in April, 1945, to 5000 tons; and in June, 1946, to 14,000 tons. Current output is said to equal the pre-war figure, and should soon exceed it. This recovery is due not only to the activities of the directors and workers of the plants concerned, but also to the progressive increase in supplies of coal, coke, wagons, and ferrous metals. If imports from the United States, Chile, and Norway are added, French agriculture has thus had between 100,000 and 110,000 tons of nitrogen at its disposal for the season ended June, 1946. It is hoped that this figure will be increased to about 225,000 tons for the season ending June, 1947.

Cut off from North African phosphates, French producers of superphosphate had to suspend output completely as from the end of 1942, but with the resumption of imports from the colonies recovery has been rapid. In 1938, output reached 1,200,000 tons. After some two years of inactivity, output was resumed in January, 1945, increasing rapidly from 177 tons in January to 3600 tons in April, 11,000 tons in July, 48,000 tons in October, and 54,000 tons in December. This steady increase has continued, and output last June reached 100,000 tons. From July, 1945, to June, 1946, total production amounted to 726,000 tons of superphosphates, of which 510,000 tons were distributed before the end of June. Output during the current season should again reach the pre-war level.

Potash

Output of potash has also increased rapidly, from 10,000 tons in June, 1945, to 50,000 tons in June, 1946. A total of 218,000 tons of potash was distributed during the season, compared with some 300,000 tons in an average pre-war season.

Among agricultural chemicals, 90,000 tons of sulphur were distributed in 1945-6, against an annual pre-war consumption of about 75,000 tons, while output of copper sulphate, the war-time shortage of which—real or imaginary—was the excuse for the requisition of copper articles from households and communal properties, is also satisfactory. Home production and imports supplied 100,000 tons during the 1945-6 season, against a consumption in 1938 of 80,000 tons.

Progress in output in the last eighteen months has been significant, production rising from only 75 tons in January, 1945, to 2132 tons in April, 4898 tons in July, and 8900 tons in May, 1946. Satisfactory as these figures may be, however, the demand for fertilisers is likely to remain high for some years to come, owing to the impoverishment of the soil through five years of under-fertilising and exhaustion.

Pharmaceuticals

The immediate post-war crisis in the French pharmaceutical industry seems to be at an end, for 1945 output was almost up to pre-war figures, while current output exceeds that of 1938 by from 30 to 40 per cent., and exports of drugs are now being resumed on an increasing scale. Accumulated demands on the part of consumers and the necessity for the reconstitution of stocks are, however, still hindering the return of normality to the market.

The position of the laboratories is much easier with regard to mineral and colloidal products, but supplies of silver nitrate, zinc oxide, and tartaric acid are still restricted. The situation of the most important alkaloids—digitalin, opium alkaloids, etc.—is satisfactory, but difficulties still remain in the supply of strychnine and spartoin. Supplies of caffeine, theobromine, theophyllin, and cocaine are almost normal, but atropine and pilocarpine are still affected by import difficulties. Recent arrivals of cinchona bark have permitted the resumption of quinine production.

Output of penicillin has now been started on an industrial scale, and by the end of the year some 50,000 million units a month will be at the disposal of the Department of Public Health.

A State-controlled organisation, the Société des Produits Biochimiques, is now being formed to undertake production of penicillin and other modern antibiotic medicines. The increase in the price of pharmaceutical products (about 200 per cent., as compared with 1939) is helping the recovery of an industry on which France is placing great stress for the development of her export trade.

Austria has started prospecting for oil in the southern province of Burgenland. Lignite deposits have been discovered at St. Michael, extending as far as Güssing.

The Chemical Society

More London Meetings

THE London programme of meetings of the Chemical Society for the forthcoming session shows a return to the pre-war prractice of having fortnightly meetings at Burlington House on the first and third Thursdays of each month. The time of meeting is to be 7.30 p.m. during 1946 and if this time proves to be acceptable to Fellows it will probably be continued into 1947.

Perhaps the most outstanding item in the programme is the Liversidge Lecture on "Some Problems in the Separation of Isotopes," which is to be delivered by Professor Harold C. Urey, Nobel Prizeman, of U.S.A., on December 18. Professor Maurice Stacey and a discussion of "Electrolytic Solutions" Tilden lectures entitled respectively, "Macromolecules Synthesised by Micro-organisms" (December 5), and "The Application of Surface Chemistry to Colloidal Problems" (February 6). On November 7, Dr. G. M. Bennett, Government Chemist, is organising a discussion on "Nitration," and a discussion of "Electrolytic Solutions" is to be arranged for April 17. The reading of original papers, to which seven or eight meetings are to be devoted, constitutes an important aspect of the Society's work, and at the first meeting of the session on October 3, papers by Professor C. N. Hinshelwood, president, on "The redistribution and desorption of adsorbed gases," and by Professor J. Monteath Robertson on "The crystal structure of pyrene," will be read and discussed.

Research Fund

Chemical Society Grants

A MEETING of the Research Fund Committee of the Chemical Society will be held in November. All persons who have received grants, and whose accounts have not been declared closed by the Council, are reminded that reports must be received by the Society not later than November 1.

Applications for grants, to be made on forms obtainable from the General Secretary, the Chemical Society, Burlington House, Piccadilly, London, W.1, must be received on or before November 1. Applications from Fellows will receive prior consideration.

Attention is drawn to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is principally devoted to the encouragement of research in inorganic and metallurgical chemistry, and that the income from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal tar and allied industries.

Science and Public Welfare

Forthcoming Conference

A CONFERENCE under the title of Science and the Public Welfare" will be held at the City Memorial Hall, Sheffield, on the afternoons of November 16 and 17. The purpose is to give people of the northern counties some insight into the part science is playing in the interests of their general welfare.

Internationally known scientists will address the conference and most aspects of scientific work will be represented. Professor P. M. S. Blackett, F.R.S., of Manchester University, and Professor J. D. Bernal, F.R.S., of London University, will speak on the social implications of science. Dr. J. Rotblat, Director of Atomic Research at Liverpool University, is to address the conference on "The Future Use of Atomic Energy." There will also be speakers from the public health services, and Captain T. W. Barnard, of the Radiotherapy Centre, will speak on the work of that institution. Medical scientists will give some indication of progress in medicine and surgery. It is hoped that a representative of the Government will give an address at one of the sessions, and it is expected that several foreign scientists will take part.

The conference is being organised by the north-east area committee of the Association of Scientific Workers, 25 Change Alley, Sheffield, 1.

SILICONES

Albright & Wilson, Ltd., have been appointed distributors of silicone resins, fluids, greases, Silastic rubber, and other Silicone materials manufactured by the Dow Corning Corporation of Midland, Michigan. These interesting new chemicals have a variety of uses in electrical insulation, lubrication, paints, instrument, and hydraulic fluids, jointing material, etc. A supply of Silicones will shortly be available in this country. Inquiries for literature and samples should be sent to Albright & Wilson, Ltd., 49 Park Lane, London, W.1 (Tel.: GROsvenor 1311).

"Chemicals for Every Industry" is the claim of Monsanto Chemicals, Ltd., Victoria Station House, Victoria Street, London, S.W.1, who have just produced a concise list of Monsanto products. In handy form, this publication contains an alphabetical list of products, with general information concerning each, in abridged form. It is pointed out that the skilled and experienced advice of the Monsanto Technical Service is available if desired.

Vinyl Resins*

Compounding and Fabrication in the U.S. To-day

THE origin of vinyl plastics dates back to 1838, when a white powder was produced by exposing vinyl chloride to sunlight. In 1872 other vinyl materials were discovered which were unaffected by solvents or acids, and rubber-like vinyl compounds were obtained in 1912. But it was not until 1927, when industry was seeking new and improved materials, that the intensive research of Carbide and Carbon Chemicals Corp. developed the first commercially successful vinyl resins. They were turned over to National Carbon Co., another member of the Union Carbide and Carbon Corp. family, to pioneer on a pilot plant scale; and when Bakelite Corp. came into the fold, all compounding of resins within the Union Carbide family naturally became that subsidiary's responsibility.

Plans were made in 1940 for a large plant at Bound Brook, N.J., where Bakelite's greatest production activities already were centred. This plant was completed in 1941, just in time to be of inestimable value to the U.S. services during the entire period of the war, since they filled a place which many of the other older resins could not, and did it extremely well.

Here the synthetic resins in the form of white powders, produced at the South Charleston, W.Va., plant of Carbide and Carbon Chemicals Corp., are compounded and fabricated. This consists of mixing the resins with the proper lubricants, stabilisers, opacifiers, and colouring materials, then fluxing and milling. The resin "doughs" are next sheeted and ground, extruded, or calendered on paper, cloth or without backing material, depending upon the form to be produced. The fluxing, milling and sheeting operations are accomplished with heated mixers and roll mills in much the same manner as rubber compounding.

Raw Materials

The principal raw materials for the Bound Brook plant consist of several types of vinyl resins, polyvinyl butyral, and copolymer of vinyl chloride and vinyl acetate. Four varieties of the copolymer are used in which the ratio of vinyl chloride to vinyl acetate covers a range from 86 : 14 to 95 : 5. In general, those resins containing large amounts of the chloride are used in flexible types of products and conversely those resins low in chloride are the basis for the rigid products.

The next most important group of raw materials from the standpoint of volume is the plasticisers. To some extent, they, too, are made at the South Charleston plant. For general-purpose plastic compounds diethylhexyl phthalate and tricresyl phosphate are used. For plasticising polyvinyl butyral resin triethylene glycol di-2-ethylbutyrate is required. Copolymer resins containing higher ratios of vinyl actate do not require the addition of plasticising agents to form rigid shapes. This probably accounts, in part, for the desirable aging characteristics exhibited by rigid materials.

Other raw materials, heat stabilisers, colorantes, fillers, and lubricants come from other suppliers. Heat stabilisers inhibit decomposition of the vinyl chloride. They are lead soaps, litharge and white lead. For colouring materials, lakes and pigments are preferred because of better light stability than dyes. The fillers consist of finely divided clay, calcium carbonates and other materials. The principal lubricants are metal soaps and fatty acids.

Raw materials are shipped to the plant by rail or truck. Resins arrive in multi-ply paper bags or in special hopper bottom boxcars, while plasticisers reach the plant in tank cars, and the other components in drums, barrels and bags. The plasticisers are stored in steel tanks outside the building. The other materials are stored in the raw materials storage space running the entire length of the building on the south side.

Handling the Resin

In the centre of this long room are two pneumatic air systems for handling the resin raw material. Bags of resin are emptied into the system's hopper and the resin is then passed through a vibrating screen located in a horizontal tank under pressure to prevent dust. Here any metallic particles or casual contamination which may have been picked up during transport of the resin will be removed. The resin is then transferred by air pressure through a 4-in. line to the top floor. Here the resin is stored in any one or more of the 28 aluminium storage bins of 35,000 to 40,000 lb. capacity each, arranged in two rows along the north and south sides of the building. The powdered resin is separated by cyclones above the bins and the air returned through bag houses and exhausted to the atmosphere.

Dry components, fillers, dry lubricants and some colours are carried to the floor below that on which the resins are stored by means of freight elevators. They are stored in hoppers equipped with dust collectors. A batch of the dry components, other than resin, is made in a weigh lorry placed beneath the hoppers. Lorry and contents are then

* *Chem. Eng.*, 1946, *53*, 120.

moved along the overhead tram-rail to a blender underneath a resin storage bin. Below the storage bins are stainless-clad steel blenders of 5000-lb. capacity. Each blender is jacketed and equipped with a horizontal ribbon agitator, which is designed to draw the mixed material to the opening in the centre of the bottom for discharging.

The batch of dry components is transferred into the blender and the resin added. Approximate weights are checked automatically and final adjustments are manual. A photo-electric device on the scale shuts off the addition of material when the predetermined weight has been reached. Plasticisers are added to the charge in the blender through metering pumps and a pipe-line running the length of the blender on one side and near the top. By spraying the liquid plasticiser over the mass the best mixing results are obtained.

Blending Process

Certain of the lubricants are too viscous at room temperature for proper blending with the resins and other components of the batch. To overcome this factor, such lubricants are heated to the point at which they are sufficiently fluid in nature to allow adequate mixing. This blending system was installed so as to improve the quality of product and to increase output from the equipment.

The blended compound in the form of a powder moistened with the plasticiser is dropped into a stainless-clad steel weigh lorry directly below the blender. The mass is held in the lorry until the mixer is empty and ready for another change. A lorry operates on an overhead tram-rail and serves two blenders. It is moved to a point above the opening in the floor through which the contents can enter a mixer.

In most cases the pigments are added to the mass in the mixer. It is not necessary to add them to the resin mass at an earlier step in the processing, and if the pigments were so added, particularly the intense ones, they would make it difficult to clean the equipment. When long runs are made, the pigments are added in the blender. The pigment used determines the method employed to disperse the pigments in the plastic compound. In some cases a 3-roll paint mill is used to grind the pigments into the plasticiser to form a paste. An intensive type of mixer is used to disperse the paste pigments with resin and is generally used when the mix is wet or damp. Dry resin-pigment mixes are blended in an end-over-end dry blender. The resultant mix is added to the mixer as a colour composite.

A system of signal lights provides communication between the mixer operator and the operator of the charging lorry on the floor above. Each mixer has a capacity of about 150 lb. of material. The mass is mixed until it reaches a predetermined temperature on the indicator. This requires from two to eight minutes, depending on the formulation. The mixer fluxes the mass by frictional or applied heat and changes the dry, bulky material into a coherent dough.

The mixer dumps the mass on to a conveyor which carries it on to a hot 2 roll mill. After further mixing on this mill it is removed by hand and placed on an elevating conveyor, which carries it to the top of a 4-roll 3-high calender. Rolls are 66 in. wide and steam heated. To govern thickness of the product, a motor is provided to move the rolls together or apart, as the case may be. The motor requires one minute to move the rolls 0.0025 in. apart. Flexible material can be calendered into tape, thin film, heavy sheeting or material to be granulated. Rigid compounds are generally calendered into sheet form.

The reason for having a number of bays and for separating them by partitions is to segregate the operations and raw materials, especially colours and resins, leading to different types of end products. In each of the bays material for a different purpose may be produced. In one bay film of 0.004 in. thick was leaving the calender. It is for use in making consumer goods, such as raincoats, shower curtains, umbrellas, etc. In another bay the calendered film is moved directly by overhead conveyor to a granulator. After granulation it is pneumatically conveyed into a cyclone and discharged on to a magnetic separator and vibrating screen. The material is then bagged for shipment. This granulated plastic is for electrical insulating and moulding compounds. Most of the bays contain two mixers. The two are required to supply the mill and calender when thick sheeting is produced.

Plastic Sandwiches

In yet another bay transparent, translucent, or opaque sheeting from 1/10,000 in. or upwards, with a matt or polished surface, is made from calendered sheeting in a hydraulic press with heated platens. The press has ten openings. Sheets of plastic are built up into sandwiches consisting of a number (depending on the thickness to be planished) of metal planishing plates and sheets of plastic, then loaded into ten openings of a 20-opening hydraulic elevator. Alternate openings are vacant. Sandwiches are transferred to empty openings in the elevator. The elevator is dropped one opening and the sandwiches to be pressed are inserted in the open press. The pressing cycle is automatic and is controlled by recording and controlling equipment. When the sheets are removed from the pressing operation they are carefully inspected under fluorescent light for imperfections and packed into paper-lined wooden boxes. To

protect the finish on the surfaces of the planished sheets and metal plates, the operators wear gloves.

Boxes of plastic sheets are handled on ball-type conveyor tables. This type of conveyor is convenient for handling boxes where there are corners to be turned and for turning the boxes around and otherwise handling them. The conveyor was constructed in Bakelite's own machine shop from ball and socket units obtained from conveying equipment companies. The steel balls are 1.5 in. in diameter and each socket unit is rated at 100-lb. load carrying capacity.

Vinyl resin coated paper to be made into linings for food product packages is produced in another bay. Vinyl resin compound plasticised with an innocuous material is calendered on to bleached sulphite paper for this purpose. A magnetic gauge continuously measures the thickness of the coating on the paper. The resin compound for the lining material is white, soft and flexible. It will not be attacked by foodstuffs and most chemicals. The resin coating and paper are of approximately equal thickness and total 0.005 in.

Safety Glass

The sandwich material for safety glass is based on polyvinyl butyral resin. The demand for safety glass is so large in normal times that the equipment in one bay is kept continually busy on this one application. The resin is plasticised with triethylene glycol di-2-ethylbutyrate. The materials are then mixed. The mass is calendered and dusted with sodium bicarbonate, which reduces the tackiness. On leaving the calender the film passes through a festoon dryer (where the water is removed) and then rolled into continuous lengths. The speed of the festoon passing through the dryer is co-ordinated with the calendering rate by two photoelectric devices.

The railway siding along the south side of the building in which the vinyl resin compounds are produced is reserved for incoming raw materials and the siding along the north side for outgoing finished products. Raw materials are stored in the space that extends the entire length of the building on the south side. Finished plastics are stored in the corresponding space along the north side. In between these two large rooms and perpendicular to them are 16 operating bays. This arrangement provides straight-line flow of materials.

The general lay-out of the building is such that extensions can be added without disrupting the present plan concerning facilities and flow of materials. The significant feature of the construction is the fact that all manufacturing areas are windowless, with artificial lighting and air conditioning for purposes of cleanliness, working comfort of personnel, and maintenance of uniform processing temperature. These features are very important from the standpoint of product quality. Every possible precaution is taken to prevent contamination of the materials during storage and processing in order to turn out a product of the highest purity and perfection. Much of the processing equipment has been made of special alloys to prevent any corrosion or even tarnishing with resultant discoloration of product. The resin storage bins are aluminium, and the blenders, lorries and hoppers are made of stainless-clad steel. All machinery has been painted white to encourage cleanliness. The operators are required to wear white work clothes. The men and women in the laminating bay wear white gloves. Dust arresters are used on several operations to help yet further in the manufacture of high quality products.

When the fabricating plant was completed in 1941, the air conditioning system was one of the largest industrial installations at that time. An interesting sidelight in connection with this great plant and its large air conditioning system is the rôle that the late Dr. Leo Baekeland, founder of the Bakelite Corp., played in the field of air conditioning. Dr. Baekeland is said to have been the father of modern industrial air conditioning (paper read before the International Congress of Applied Chemistry in Berlin, 1903).

This air conditioning system consists of two compressors, each with a capacity of 500 tons per 24 hours of refrigeration. Only one is used regularly during the summer months; the second is used for stand-by service and for possible additions to the buildings.

The volume of air circulated in each of the 16 manufacturing bays is 45,000 cu. ft. per min. All the air is filtered and half of it is conditioned to 85° F. and 40 per cent. relative humidity, to be circulated in the working area. The balance of the air is filtered raw air and is circulated inside the machine enclosures. The positive air pressure maintained in each bay, for the purpose of excluding airborne dust, is a fraction of one inch hydrostatic water pressure.

George Kent, Ltd., Luton, who employ 2000 people in the manufacture of meters and industrial instruments, have hit upon an admirable method of making known their principal standard productions, without infringing current paper restrictions, by producing a miniature catalogue, the first of the post-war editions. The catalogue loses none of its usefulness by reason of its reduced size, but acts as a quick reference guide to a wide range of products which have gained a high reputation. Publications giving full details are available for each product, and their reference numbers are given in the miniature catalogue, which is very well illustrated.

LETTER TO THE EDITOR

Compound "1553"

SIR,—In your issue of August 31, p. 257, reference is made by your Cape Town Correspondent to "1553" and it is stated that this preparation was being obtained from America. This is not correct: "1553" is a purely British development.

The compound, 2: 7-diamino-9-phenyl-10-methylphenanthridinium bromide, was first synthesised at the Chemical Research Laboratory, Teddington, by Dr. L. P. Walls. It is, in fact, compound number 1553 in the C.R.L. series. It was found to be active against *Tryp. congolense* by Professor C. H. Browning, F.R.S., of Glasgow University. Tests in Africa proved its efficacy against nagana. The drug is being manufactured by Burroughs, Wellcome & Co. and May & Baker, Ltd.—Yours faithfully,

R. P. LINSTEAD,
Director.
Chemical Research Laboratory,
D.S.I.R.
Teddington, Middlesex. September 17.

Streptomycin

Production Planned in Great Britain

THE CHEMICAL AGE was informed this week that pilot-scale production of streptomycin is to be undertaken by a number of British firms, with the co-operation of the Ministry of Supply, Ministry of Health, and the Medical Research Council. It is hoped that preliminary clinical trials will begin before the end of the year. The firms at present concerned are Boots, Glaxo Laboratories, and the Distillers Company, who are all established penicillin manufacturers, and the Heyden Chemical Company, who propose to instal a factory to produce penicillin and streptomycin at Ardrossan, Scotland.

Streptomycin will not be released for use by the general medical profession until the clinical conditions which respond to it have been clearly established. The clinical trials of necessity will be prolonged; in the meantime, plans for large-scale production, to meet the demands of the medical profession as a whole, will proceed. The drug, which was discovered and developed by U.S. scientists, is already undergoing clinical trials in America for the treatment of all types of tubercular infection, dysentery, typhoid and para-typhoid fever, and certain types of infection of the urinary tract—particularly those which do not respond to penicillin or sulphonamides.

Indications are that streptomycin, which, like penicillin, is produced from a mould, will be the more expensive of the two on a treatment basis. Although streptomycin is already in pilot-scale production in the U.S., supplies at present are so small that none can be made available to this country.

Applied Chemistry Classes

Day and Evening Courses

NORTHAMPTON Polytechnic, St. John Street, London, E.C.1, has issued its prospectus and syllabuses of part-time (day and evening) courses in applied chemistry for the new session which opens next Monday, September 30.

Evening courses are provided in chemistry, electro-plating, fuel technology and metallurgy, and part-time day courses in chemistry and metallurgy. The evening courses are intended for students able to attend on three evenings a week; at the same time, modified arrangements are made to meet the requirements of students unable to follow so comprehensive a course of study. A part-time day course in metallurgy is arranged to meet the requirements of employees released by their employers for one day a week throughout the session. Classes in chemistry in preparation for matriculation and Intermediate B.Sc. (Eng.) in engineering chemistry are also held.

Of particular interest are the part-time day and evening courses in glass technology, the former involving attendance for one day per week, while the latter involves attendance on three evenings. It is intended that the full course shall extend over three years and it will provide a theoretical background, together with instruction in the practice of glassworking.

In addition, a number of special courses has been arranged. A course of four lectures on "Electro-deposition Plant" will be given on Wednesdays, November 6, 13, 20 and 27, each beginning at 7.30 p.m. The fee for the course is 10s. Beginning on October 8, there will be a course of lectures on "Combustion and Furnace Practice" on Tuesday evenings at 7 p.m., for which the fee is one guinea, and on October 10 there will begin a course of lectures on "The Occurrence, Production and Properties of Solid Fuels" on Thursday evenings at 7 p.m., the fee again being one guinea. Admission to the special courses mentioned can be effected by personal enrolment at the Polytechnic any day between 10 a.m. and 7 p.m.

The Magnesium Association, New York, is arranging to hold an international magnesium congress in New York on October 3-4. Delegates will probably number 450. Major C. J. P. Ball, D.S.O., M.C., chairman of the board of Magnesium Elektron, Ltd., London, will be the principal speaker and guest of honour.

Casein

Its Manufacture and Applications

by GUY G. S. DUTTON, B.A., A.R.I.C.

THE appearance of finely ground casein leads many to suppose that it is related to cereal products such as wheat flour. In actual fact casein is a protein type of compound obtained from milk. All proteins contain carbon, hydrogen, nitrogen, many sulphur, and a few phosphorus. It is to this latter class of phospho-proteins that casein belongs. It may be said that casein is one of the proteins upon which most work has been done and this is attributed to the fact that it has been known from time immemorial and is easily obtainable in large quantities.

As shown in Table 1 the percentage of casein in different varieties of milk vary over fairly wide limits, there being 4.6 per cent. in sheeps' milk, while human milk contains only 0.5 per cent. It is a curious fact that despite the huge variety of proteins the constituent atoms are present with uniform regularity. Thus the percentages vary between the following limits: Carbon 52-55, hydrogen 6.9-7.3, oxygen 20-24, nitrogen 15-18, with small amounts of other elements. That these figures accord with the analysis of casein from various sources is illustrated by Table 2.

TABLE 1.

Casein Content of Typical Milks (per cent.).

	Cow	*Sheep*	*Goat*	*Ass*	*Mare*	*Human*
Water ...	87.80	83.5	85.0	89.5	91.2	88.3
Casein ...	3.20	4.5	3.7	0.8	1.3	0.5
Butter ...	3.50	5.2	4.7	1.6	1.0	3.0
Albumen ...	0.30	1.8	1.3	0.8	1.7	1.9
Lactose ...	4.75	4.8	4.3	5.7	5.6	6.5

TABLE 2.

Elementary Analysis of above Casein (per cent.).

	Cow	*Sheep*	*Goat*	*Ass*	*Mare*	*Human*
Carbon ...	52.69	52.92	52.90	52.57	52.36	52.24
Hydrogen ...	6.76	7.05	6.86	7.01	7.09	7.32
Nitrogen ...	15.65	15.71	15.48	16.28	16.44	14.97
Sulphur ...	0.83	0.72	0.70	0.59	0.53	1.12
Phosphorus ...	0.88	0.81	0.76	1.06	0.88	0.68

Despite the large amount of work which has been expended on the analysis of casein it is still not possible to ascribe a satisfactory formula. Suggestions which have been put forward vary between the two extremes $C_{160}H_{257}N_{11}SPO_{51}$ to $C_{172}H_{274}N_{44}SPO_{55}$. The molecular weight has been assigned a minimum value of 12,800, but from other considerations it is concluded that the actual molecular weight is about 192,000.

Further reference to Table 1 shows that ordinary milk contains a certain proportion of butter fat. This fat is removed from the milk before the latter can be used for the production of casein. This is necessary because the presence of the fat is detrimental to the casein and it also has a value in itself. The separation is normally effected by passing the milk through a high speed centrifuge which will separate the fat leaving skimmed milk.

There are three main methods which may be used for the precipitation of the casein and the choice of the appropriate one will normally vary in accordance with the final use to which the casein is to be put. These three methods are: (1) Natural sour or lactic acid method, (2) rennet method, (3) sulphuric or hydrochloric acid method. The essential treatment of the milk, which in each case is slightly different, is set out below.

Lactic Acid Method

The skimmed milk contains its lactose, or milk sugar, content and, when this is acted on by lactic acid bacilli, fermentation takes place with the formation of lactic acid. The skimmed milk may therefore be left to stand in vats at the temperature most favourable to the action of the bacillus, but where production is on a continuous basis it saves time to add a small amount of the sour whey from a previous precipitation. It is customary to keep a certain amount of whey from day to day for this purpose. About 5-10 per cent. of whey will produce the right effect and, when the milk has developed sufficient acidity to give a soft curd, the milk is heated directly by steam. During this time the milk is vigorously stirred with long wooden paddles until a clear separation of the curd and whey takes place. In practice it is found that a temperature of about 110°F. gives the best results with the curd collecting in the bottom of the vat in a more or less solid mass with the whey on top but not containing small particles of curd.

The clear whey is drained off through a treacle valve over which is fastened a piece of cloth to catch any small pieces of curd that may still remain. At this stage the amount of whey required for following batches is preserved and allowed to sour. The curd remaining at the bottom of the vat is next washed with large quantities of water which have been acidulated to pH 4.8 —the isoelectric point of casein. The curd is now placed in a hessian cloth whence the excess of water is allowed to drain.

Rennet Method

The precipitating agent for this method, rennet, is the saline extract from the fourth stomach of a calf. It is made up to a 2.5-5 per cent. solution in water and is added to the milk at the rate of 5-20 cc. per gallon while the temperature is maintained at

104°F. As soon as the curd has formed the whey is drained off and the curd cut up into lumps which are then heated to 150°F. to destroy the action of the rennet.

The concentration and the percentage of the rennet has very definite effects on the quality of the curd produced. The stronger the solution the firmer, drier, and more compact is the product. It is found that the action of the rennet below 65°F. or above 140°F. is imperfect, while generally round about 100°F. is found to be the best temperature with the amount of rennet adjusted to give complete precipitation in 20-30 minutes. During the addition of the rennet the mixture must be stirred continuously and it is a matter of great experience to get the speed correct. The addition of a small percentage of calcium chloride (0.01) gives a 3 per cent. increase in yield and a curd from which the whey drains more readily.

Acid Method

When precipitating with hydrochloric acid the milk is first warmed to 140°F.; the acid, which has been diluted with three parts of water, is then slowly added in a thin stream with constant stirring until the mass shows signs of clotting. The stirrers are then stopped and the curd comes down as a flocculent precipitate which is allowed to settle and from which the whey is drained. The curd is then washed with acidulated water, allowed to settle again, and the water run off. This process is repeated until the washings are clear and then the curd is removed and allowed to drain.

It must be emphasised that in the last two methods a trial test must be made in the laboratory to determine the amounts of precipitating agent necessary for the best results. This is essential, since no two lots of milk are ever the same, as they will vary according to the state of health of the cow, what the cow has been fed on, and the time of year.

Preparation by any of the above methods yields raw casein containing a large quantity of water which must be eliminated before the curd can be ground. This is done in two stages. The first stage consists in using a curd press which may be likened to a large letter press in which all the parts are made of well-oiled wood. The curd is spread out on to slatted boards several of which are then inserted into the press. When the curd comes out of the press it is in the form of hard sheets containing up to 50 per cent. water. To facilitate further drying the curd has to be broken up into small lumps and this is best effected by using a curd mill, the best types of which consist of two slowly revolving cylinders on which there are spikey teeth. These teeth break up the curd which falls to the bottom, there coming into contact with a rapidly revolving arm which forces it through a medium mesh screen. The casein, which is now in the form of small lumps, is placed on trays so that it may be passed through a tunnel dryer. A type of dryer which is in common use has the following dimensions: the trays are often 30 in. square so that the tunnel is built 30 in. wide, 22 ft. long, and 6 ft. high. Such a tunnel will hold the casein from 30,000 lb. of milk when full. The hot air is supplied by a low-pressure fan at a temperature of 130-135°F., and it has been found that the best results are obtained if the amount of air entering the dryer is 4 cu. ft. per minute per lb. of curd. By almost any of the above methods 100 lb. of milk will give 7 lb. of moist casein which will itself yield 2 lb. of dry casein.

It is evident from these figures that the milk will be processed in the country of origin and that it will be the casein which is shipped as the raw material. The majority of industrial casein is prepared from cow's milk and it therefore follows that the most important casein-producing countries are those which have large surpluses of milk. These countries were the Argentine Republic, U.S.A., New Zealand, and India. Before the war the cost of skimmed milk in the Argentine was about 0.1d. per gallon compared with about ¾d. per gallon in Ireland. The Argentine is still the main supplier of the world's casein; the material supplied is light yellow or cream coloured, very uniform from shipment to shipment, and gives a solution with a good medium viscosity. Indian casein made from buffalo milk used occasionally to appear on the European market, but since it varied greatly in quality owing to the crude methods of production it was not in great demand.

Grinding

Although casein cannot be described, from the point of view of grinding, as a hard raw material, nevertheless it does present some very tricky problems since the operation of grinding is one of the most important in converting the raw material into a form suitable for industry. It might therefore be expected that modern high-speed grinders would perform a better job than the old-fashioned grindstone. Such grinders have indeed been tried, but it has been found that the high speed produces a temperature sufficiently high to burn the casein and render it useless. Grinding is therefore carried out by means of French burr stones, after passing the material through a crusher mill if the casein is very hard.

The grinding process may briefly be described as follows. The unground casein, which arrives in this country in sacks, is tipped into a hopper underneath which is the crusher. In the hopper a series of

parallel magnets are situated in order to remove metal particles. From the crusher the casein emerges reduced to 30-mesh and it is then conveyed by an enclosed bucket elevator to the hopper for the burr mills. From the latter the ground casein is conveyed to a series of rotating sieves composed of hexagonal cylinders having walls of silk material stretched on formers. From these sieves casein of any desired mesh may be obtained by use of the appropriate silks but the most common grades normally met with are either 30, 60, 90 or 120-mesh.

The solubility of casein in water is only 0.11 g./litre at 25°C., but, owing to its acidic nature the solubility may be greatly increased by using an alkaline solvent. The most common industrial solvents are borax (15), ammonia (10), lime (25), sodium carbonate (5), and caustic soda (5). The figures in brackets indicate the approximate percentages required to dissolve good-quality commercial casein, although it must be realised that the actual amounts required will vary according to the acidity of the casein.

When preparing casein solutions it is important that the casein should all be of the same mesh. If the powder contains both coarse and fine grains it will be found that although the fine grains will dissolve readily it will be most difficult to get the coarser particles into solution.

Test of Quality

One of the easiest ways of deciding the quality of a sample of casein is to prepare a solution and note its appearance. A good sample of casein will dissolve completely, giving a pale cream-coloured solution, whereas poorer samples will invariably contain a sediment. For more accurate work the viscosity of a solution prepared in a standard way is a good guide to the quality. It is always found that poor caseins have a low viscosity, but the converse is not necessarily true since the value may be raised or lowered by the addition of small amounts of organic compounds. For most test purposes borax is used as the solvent and the casein, usually 90 mesh, is mixed dry with about 15 per cent. of borax, and the mixture then dissolved in water. If ammonia is used as the solvent it is best to add the casein to the correct amount of water, at a temperature not exceeding 120°F., and then the ammonia. It may be noted in passing that the working basis for all casein solutions is approximately 1 lb. to 1 gall. of water.

If it is desired to keep casein solutions, preservatives such as carbolic acid or thymol may be added. The rate of putrefaction of a casein solution depends to some extent on the nature of the solvent used. Thus a solution with a large excess of ammonia keeps for a long period without the addition of a preservative, but if sodium carbonate or caustic soda is used putrefaction sets in quickly. An alternative preservative is nitrobenzene which may be used at the rate of ½ to 1 per cent. and will also serve to keep the viscosity stable. A third use for nitrobenzene is for denaturing food casein which in most countries is a dutiable commodity. This is done by the insertion, into each container, of a sheet of absorbent paper soaked in the liquid.

Uses in Industry

(a) *The Paper Industry*. It has been estimated that between 60 and 70 per cent. of the world's casein production is absorbed by the paper trade. The printer's need for a paper capable of taking good half-tone impressions has led to the production of glazed papers produced by impregnation with inorganic fillers for which binders are necessary. Three common binders in use are glue, starch, and casein, but the amount used of the latter is much greater than the sum of the other two. The disadvantage of starch is that owing to the large size of the particles it will pick off easily while, glue has the unfortunate property of imparting a disagreeable odour to the paper. Casein suffers from neither of these disadvantages and in addition is easily rendered waterproof.

In Europe the only type of casein used for the paper trade is self-sour lactic which is imported straight from the Argentine. The casein is ground to 30-mesh before dissolving, since if it is ground to 90-mesh, although solution is speedier, there tends to be some insoluble grit from the grindstones. As the gloss of the paper is proportional to the amount of the fat, it is desirable to analyse the casein for this constituent before use. Among the inorganic fillers which may be used are satin white—a lake formed by slaking lime with aqueous aluminium sulphate—china clay, talc, and chalk. Satin white gives the highest gloss, provided that the other conditions are equal, while clay will work well with casein solutions, giving a finish only slightly less glossy than that achieved with satin white. Blanc fixe or precipitated chalk give matt or semi-matt finishes but neither is as waterproof as satin white. A typical formula is as follows: lactic casein 9, borax 2, blanc fixe 60, talc 1, water 24, and special soap solution 4 per cent. by weight. The special soap solution is made by boiling together carnauba wax 20, potassium carbonate 1.25, and water 72.75 per cent. A greater degree of waterproofness can be obtained by substituting caustic soda for the borax and, when solution is complete, adding aluminium sulphate equal in weight to 1¼ times the weight of caustic soda employed.

To a lesser extent casein is used in the wallpaper trade where it has great value as a waterproofing varnish which may be ap-

plied to the paper after hanging or during manufacture. The solution must however be suitably modified in order to produce a flexible film. One other advantage is that when used in connection with silver and gold patterned papers it prevents the metallic powder from being rubbed off or tarnished.

(b) *The Paint Trade.* At the present day casein is the most favoured binder in the preparation of distemper and similar water paints which are rapidly growing in importance owing to the ease with which they can be applied to a variety of surfaces. Casein-bound distempers do not rub off, they are washable, and they dry rapidly with a matt coat which for some jobs is an essential quality. To manufacture these paints the casein is mixed with a predetermined amount of hydrated lime. The quality of the lime is of prime importance and the quantity has to be accurately adjusted since if there is insufficient casein the paint will not be resistant to rubbing or the action of water, while if there is too much binder present not all the casein will be reconverted to the insoluble state and so is liable to peel off.

Purity of Tones

The purity of the tones that can be obtained is characteristic of casein paints. Pale yet vivid shades of red, grey, blue, green, and violet are made by using a little of the colouring matter with a large proportion of filler. The filler may be china clay, lime, powdered chalk, talc, or barytes, while suitable pigments are ochre, chrome green, carbon black, zinc white, etc. The casein, the filler, and the pigment are all ground separately and then sieved, after which they are put into a mixer where, owing to the different densities, it is found best initially to mix slowly and then gradually to increase the speed. It is found that the pale shades require less casein than the dark pigments and that those paints which have organic colours require less than those where inorganic colouring matter is used. The nature of the surface to which the distemper is to be applied also regulates the amount of casein to be used. Thus, if the paint is to be used on a firm base such as cement, the colour should contain more casein than if it is going to be used on plaster; in the latter case, where the tendency to peel off is very noticeable, the casein content is reduced while that of the lime is increased.

Modern distempers contain linseed oil in addition to casein which gives added durability and water proofness. For outside work a paint with almost the same degree of hardness as an oil paint may be made by incorporating a little magnesium silicate in the mixture.

Although casein distempers dry with a matt coat this can be brightened for interior work by spraying the finished surface with waxes dissolved in turpentine. When working with casein paints it is essential to see that a greater quantity of solution is not made up than can be used in one day, since after 12 hours casein paints begin to loose their adhesiveness.

Although much time and research has been expended on trying to find a suitable plasticiser for casein, no success has yet been achieved. If this were possible the scope of casein paints would be greatly increased since they could be used for coating articles where a thin flexible film is required and at the same time the casein cinema film would become a possibility.

(c) *The Plastics Industry.* The foundation of this important industry dates from 1897 when the German Ministry of Education offered a prize for a slab which was to be white and washable and upon which one could write with a lead pencil, the intention being to replace the school slate. The prize was awarded to a Mr. Krische who had the idea of coating a piece of cardboard with a casein solution and then waterproofing it.

The casein plastics industry cannot be said to have started in Great Britain until 1909, and in subsequent years its importance greatly increased although it is not being displaced by more modern synthetic materials. This is illustrated by the fact that it has recently been reported that no new machinery has been installed in German casein plastic factories since 1930.

Preparation of Plastics

For the preparation of plastics the casein is charged into hoppers, which act as a measure for each mixing machine, and is then mixed with fillers in a dry state. During this mixing the dye is dissolved in the minimum quantity of water and is then sprayed on to the mix. The next operation is the extrusion: this is carried out in an extruder which consists essentially of a water-jacketed worm, arranged so that the whole mass can be uniformly heated, inside a box fitted with a nozzle. As the worm turns, the mix is forced out through a nozzle giving either rods or tubes according to the construction of the nozzle. If it is desired to produce a mottled pattern, as for fountain pens, coloured rods are made by extrusion and then hardened. They are cut into 5-mm. lengths called nibs, and then mixed with a fresh charge of the basic colour material. This is then passed through the extruder in the usual way but the nibs, having been previously hardened, will stand out from the base material, giving the desired effect.

When the material is required in sheets these rods are cut up into lengths of 6-8 in. and placed between steel sheets where they are steam heated and subjected to pressures of 150-200 tons. When the sheets emerge

they are still fairly soft but rigid enough to stand upright in tanks of formaldehyde. Here the sheets are left to stand for a time dependent on their thickness, after which they are dried by a stream of air heated to 27-32° C. During this drying process the sheets are inclined to warp, so that they are afterwards straightened with a hydraulic press.

Two methods are employed for polishing the sheets. The first of these, known as the buff method, consists of rubbing the material with fine-grade carborundum and then with canvas and swansdown buffs, using special fine powders. The second method is of a chemical nature and consists of using a bath containing sodium hypochlorite 1 part, water 8½ parts, and to every 10 gallons of solution are added 8 oz. of caustic soda. The articles to be polished are immersed in the solution at a temperature of 60-70° C. for 2-3 minutes. The articles are then placed in clean water at the same temperature, after which they are dried. With delicate shades it is sometimes found that a certain amount of discoloration will take place. This may be prevented by the addition of two pints of 100 vol. hydrogen peroxide to every 10 gallons of the solution.

Disadvantages

Two of the main disadvantages of casein plastics are that at 130° C. the plastic may show signs of discolouring, although this is only noticeable with delicate colours; but at 160° C. all colours are affected. In addition the material is to some extent hygroscopic which makes it unsuitable as an insulator for high-tension work although it is suitable for low tensions.

(d) *Food and Medicinal Applications.* Food casein is made in much the same way as commercial casein precipitated with hydrochloric or sulphuric acids, except that in the place of these acetic acid is used as the coagulating agent. (The importation of food casein has been prohibited since the early days of the war.) The acetic acid is added as quickly as possible in order to produce a hard curd, which, after washing with water, is dried and mixed with the calculated amount of sodium carbonate, the latter acting as the solvent when the casein is dissolved in water. Since the percentage of phosphorus in casein is small it is often desirable to incorporate some additional phosphorus in the finished product. This is done by adding sodium or other glycerophosphates. An analysis of a typical food casein (Laitproto number 6) is: protein 92, fat 0.75, and ash (including phosphates of sodium, etc.) 7.25 per cent. An important fact which is not revealed by the above analysis is that the casein still contains the valuable enzymes present in fresh milk.

Since human digestion is mainly intestinal, whereas that of the cow is stomachic, cow's milk is not greatly suited to small infants as it tends to form lumpy curds in their stomachs. Children's foods often contain food casein mixed with sodium citrate which latter increases the amount of calcium present by reversable double decomposition; this in turn retards the action of the coagulating enzymes, so that when coagulation does occur a soft curd is produced which the infant can manage with greater ease.

Other Applications

Among other applications of casein in the food trade are its uses for glazing pies, sausage rolls, ets., and for incorporation into ice cream in order to impart a smooth texture, besides giving it some food value.

In the cosmetic industry casein finds its main outlet in the production of cleansing creams, where its adhesive properties are used to extract dirt from the pores of the skin. Compounded with metals it finds a variety of uses: *e.g.*, ferric caseinate is used as a tonic and blood improver, while a bismuth compound is used for dressing wounds.

(e) *The Leather Industry.* The seasoning of leather used to be carried out by such natural products as Irish moss and blood albumen, but these are now obsolete, their place having been taken by casein finishes. It is estimated that about three million gallons of leather-dressing are used in the U.K. per annum and casein is the most important constituent in the majority of these finishes.

Seasoning is the last operation performed on the leather before it leaves the tannery to be made up. It consists in the application to the grain surface (*i.e.*, the outside of the animal's skin) of a solution which will impart a gloss to the leather. This is achieved by applying a casein solution and then rolling the leather between glass cylinders. Although the gloss produced by casein is not so good as that from blood or egg albumen it has the advantage that it will last longer owing to its superior waterproof qualities.

(f) *Glues.* The status of the casein glue trade is much the same as that of the plastic trade, that is to say that although casein glues have been of the very greatest importance they are now being replaced by various synthetic resins. Casein glues have been known for a long time, but one of the factors contributing to their development was the great demand in the first World War for aeroplanes which were made of wood and had laminated wooden propellers. An idea has grown up that casein which is not fit for anything else can be used for making glues. This idea is quite erroneous and the quality has a decided effect on the strength of the glue. In this connection it has been shown by the British Adhesive

Research Committee that the presence of fat does not effect the waterproof qualities, but the strength is greatly diminished, while excess of an inorganic salt will cause brittleness. The earlier casein glues were troublesome to use, since once the solution had been prepared it would not stay open for very long, but this has been overcome by the introduction of a very small percentage of sodium sulphite.

Government Control

Since casein is derived from milk it is obvious that the supply will vary with the seasons, and this, together with certain other causes, results in wide fluctuation in price. In order to control dollar purchases all casein during the war was bought by the Ministry of Supply which function is now carried out by the Board of Trade. This department is assisted by the Lactic Casein Importers' Association at 23, St. Swithins Lane, London, E.C.3, and application should be made to them for licences to purchase, stating the purpose for which the casein is required.

The Montecatini Group

Senator Abbiate's Speech

DETAILS have just been received in this country of an interesting speech made by the president of the board of administrators of the Montecatini group, on the occasion of a recent extraordinary general meeting. On the general situation of Italy's industry, Senator Abbiate remarked that it was characterised by marked differences in the operating conditions among individual enterprises in each main group of industries. While certain industries had to struggle against serious difficulties, there were others in which the volume of production had almost reached a normal level. In those spheres of industrial activity which are controlled by the Montecatini group, conditions might, on the whole, be described as middling. As a result of a close co-operation between the company and its workers and employees, output, which had at one time fallen very low, had been increased and in a number of cases the most favourable production targets had even been surpassed. Special progress had been made in the group's mining activities; for instance, output of pyrites for the first four months of the current year was equal to the whole of last year's output, and the subsequent months have witnessed further improvement. A considerable increase in the annual output of pyrites has thus to be reckoned with, which, it is hoped, should allow of appreciable quantities for export. In view of Italy's poverty in home-produced fuels, special significance attaches to the progress made in the Ribolla coal mines. Satisfactory reports on the group's production of sulphur and bauxite continue to come in, but the slow revival of building activities has, so far, obstructed an increase in the output of marble.

Production in the Montecatini chemical works amounts at present to about 50 per cent. of the normal pre-war level. An improvement in the fertiliser supply position is expected as a result of larger imports of phosphate rock, and it is hoped that it will soon be possible to meet the farming community's substantial requirements for phosphate fertiliser. Deliveries of nitrate fertiliser and of insecticides have steadily improved in recent months and production of copper sulphate—an item of special importance to Italy's agriculture—has attained a level that has not been attained for a good many years past. The rehabilitation of war-damaged fertiliser plants has been given priority and a start has been made with the erection of additional new units. As a result of the efforts made in the fertiliser sector, Italy should soon possess a modern and efficient fertiliser industry.

As to the production of dyestuffs by the Montecatini's subsidiary, the "ACNA" (Azienda Colori Nazionali Affini), in which the I.G. Farben formerly held 49 per cent. of the share capital, lack of coal has made it impossible to satisfy domestic demand. However, a marked improvement in the quality of the company's products has been noted in recent months. The plants of the Società Farmaceutici Italia ("Farmitalia"), at Settimo Torinese, which have been established in co-operation with the French Rhône-Poulenc group, and which had suffered no war damage worth mentioning, report a satisfactory volume of activity. Output of plastics and of varnish is at present higher than before the war, and satisfactory progress has also been made in the manufacture of products required by the metal, textile, and paper industries.

While the position of the group's explosives sector, many units of which were seriously damaged during the war, is said to be unsatisfactory, the Società Industria Nazionale Alluminio ("I.N.A."), another subsidiary engaged in the manufacture of aluminium with plants at Mori and Bolzano, reports a high level of employment, regardless of the generally easy situation on the world aluminium market. The Montevecchio-Società Italiana del Piombo e dello Zinco, a subsidiary engaged in the production and smelting of lead and zinc, has staged a remarkable recovery after its Sardinian smelter had been idle for 28 months

Personal Notes

DR. T. F. DIXON, biochemist to British Drug Houses, Ltd., has been appointed Professor of Biochemistry at the Royal Medical College, Baghdad, and expects to assume duty at the end of next month.

MR. JOHN SHEARER, M.A., B.Sc., principal science master at Stromness Academy, has been appointed Director of Education for Orkney and executive officer of Orkney Education Committee.

MR. H. M. GALE, who has been a research engineer with A. Reyrolle & Co., Ltd., Hebburn, for 15 years, is to take up a new appointment on October 1 with Elliott Bros. (London), Ltd., makers of scientific instruments, who are opening a new research station at Elstree.

MR. A. E. TUCKER, who recently retired after 47 years' service with Walworth, Ltd., the last 22 years as warehouse superintendent, has been presented by his friends in the company with a suitably engraved watch, to commemorate their long and pleasant association. He has been succeeded by Mr. Albert G. Cook, who has been with the company for 21 years.

PROFESSOR P. M. S. BLACKETT, PROFESSOR M. POLANYI, and SIR HAROLD HARTLEY are among the distinguished scientists and scholars who have accepted invitations to participate in the first series of conferences (starting this week) by which the bicentenary of Princetown University is being commemorated. The series of conferences, convocations, etc., will continue throughout the academic year, ending in June 1947.

MR. E. S. LITTLE has been appointed a director of Associated Electrical Industries Finance Co., Ltd., which is concerned with the financial operations of all the companies of Associated Electrical Industries, Ltd., including the British Thomson-Houston Co. In consequence of his new appointment, Mr. Little has retired from the board of the British Thomson-Houston Co., Ltd., but he continues to be comptroller and secretary of that company.

DR. F. A. FREETH, F.R.S., technical adviser to the Central Staff Department of I.C.I., who has been representing the Chemical Society, the Faraday Society, and the Society of Chemical Industry at the 20th Congress of the Société de Chimie Industrielle in Paris during the past week, has been made an honorary member of the French Society of Chemical Industry.

MR. GEOFFREY HEYWORTH, who is chairman of Lever Bros. and Unilever, Ltd., and vice-chairman of its sister company, Lever Bros. and Unilever Mij., has accepted the invitation of the Lord President of the Council to be chairman of the Advisory Council for Scientific and Industrial Research, as from October 1, in succession to Lord Riverdale, who is retiring after holding the appointment for nine years. The Lord President has appointed PROFESSOR H. W. MELVILLE, Professor of Chemistry at Aberdeen University, to be a member of the Advisory Council, from the same date, in succession to Sir Franklin Sibly.

Obituary

MR. BENJAMIN LEECH, M.A., F.R.I.C., of Macclesfield, Cheshire, who is presumed to have been lost in a gale while sailing in the Mersey Estuary with two friends on September 14, was well known in Cheshire as a consulting and analytical chemist, in private practice. He was formerly associated with the firm of Mary Leech, dyers, and was on the consulting staff of Macclesfield General Infirmary. He was an experienced yachtsman and held a captain's certificate.

Institution of Chemical Engineers

Associate-Membership Examination

OF the 52 candidates who presented themselves for the 1946 Associate-Membership Examination of the Institute of Chemical Engineers, 35 satisfied the examiners, seven were failed, and ten were referred in certain sections. The general standard of the answers was less high than in the last few years; the drawing paper was again poor, some of the candidates, indeed, giving no evidence that they had any knowledge of projection, while others were very inexperienced in reading drawings.

The following list gives the names of the successful candidates, among whom MR. B. J. GEE has been awarded the William Macnab Medal as a result of his examination work, while the papers of MR. D. E. B. GREENSMITH were very highly commended.

Pass List

MESSRS. K. ASTIN, E. BAILEY, R. F. BAILEY, I. BERKOVITCH, C. O. BISHOP, W. R. BULCRAIG, H. W. CHATFIELD, A. L. CUDE, R. A. L. DAVIES, R. ELLISON, R. R. FERNER, R. GARDNER, B. J. GEE, D. E. B. GREENSMITH, K. GRIFFITHS, E. HENRY, G. HOLLAND, R. HUTT, E. R. B. JACKSON, H. JACKSON, J. K. LORD, J. F. MATTHEWS, T. G. MEYRICK, K. OWEN, G. H. RADFORD, R. B. RISK, J. B. SEED, L. C. SUMMERVILLE, C. H. SWEDLER, F. H. H. VALENTINE, O. B. VOLCKMAN, J. C. VOSKAMP, W. A. WANSBROUGH-JONES, R. G. WILLIAMS, and J. WOOD.

The Council has decided that the fee for the 1947 and subsequent examinations shall be increased to £5 5s.

General News——————————From Week to Week

Dr. J. H. Quastel's brilliant lecture on "Soil Metabolism," delivered in London last year, has been issued in pamphlet form by the Royal Institute of Chemistry, and forms an essential weapon in the armoury of the agricultural chemist.

Townson and Mercer, Ltd., Croydon, is the new address of that firm. Their new permanent factory, stores and offices adjoin Beddington Lane Station, on the edge of Mitcham Common. The telephone number is Mitcham 1161.

A Board of Trade booklet, now available at H.M. Stationery Office, contains a list of Government goods and raw materials which may become surplus, with names and addresses of the departments responsible for disposal and their liaison officers.

Candidates for the examination for the Associateship of the Royal Institute of Chemistry, which will be held in the week beginning January 20, 1947, are reminded that their applications must reach the Institute by November 4, while their entry forms must be received by November 11.

Organon Laboratories, Ltd., will be employing about 500 persons at their new Scottish factory on the Newhouse Industrial Estate, Lanarkshire, when the factory is in full production. Houses are being erected at the neighbouring township of Holytown, for key workers at this and other new factories on the estate.

It is reported from Scotland that the "Britain Can Make It" exhibition may be transferred there for a month early in 1947. A formal resolution was passed by the Scottish Council of Industrial Design recommending to the Board of Trade that the exhibition be sent to the Kelvin Hall, Glasgow.

Under the terms of the will of the late Mr. G. S. Albright, a director of Albright and Wilson, Ltd., chemical manufacturers, Oldbury, who left £507,972, on which £185,948 duty has been paid, three of thirty-two parts of the residue are bequeathed to the trustees of a deed to be held on trust for the benefit of the staff and workpeople of Albright and Wilson, Ltd.

The formation of a society concerning itself with photoelasticity was discussed at a recent meeting at University College, London. It was decided to extend the scope to other techniques of experimental stress analysis and to form an informal group for the interchange of knowledge and experience. Readers who are interested in experimental stress analysis are invited to communicate with the hon. secretary, Mr. E. K. Frankl, Engineering Laboratory, Cambridge.

A monograph on "Microchemistry and its Applications" has been published by the Royal Institute of Chemistry. It is the work of Mr. Ronald Belcher, F.R.I.C., who is among the soundest and most trustworthy authorities on the subject, and is based on three lectures delivered in 1940-44, forming an admirably concise and useful manual for all workers concerned.

The severe flooding in Yorkshire during the latter part of last week resulted on Friday in 400 workpeople being sent home from the Deighton works of I.C.I., Ltd., after the River Colne had burst its banks and flooded one section of the plant. Firemen had the task of pumping 15,000 gallons of flood water from the Yorkshire Coking and Chemical Co., at Castleford, in order to prevent the water rising to a level at which the entire plant would have been put out of action.

At the annual sales conference of Vitax Fertilisers, Ltd., held recently at Liverpool, future plans were dealt with and exhibits of new or prospective lines were on show. A dinner at the Adelphi Hotel closed a day which was felt to have been extremely instructive. Present were the directors. Mr. G. W. Wagg (general sales manager), Mr. H. Stansfield (works manager and chemist), and Mr. A. O. Rylance (export manager), together with salesmen and technical staff, and key members of office and factory staff.

Foreign News

Demand for DDT in South Africa is mounting, according to the Minister of Economic Development.

From Finland it is reported that fertilisers in that country will be in short supply throughout this year.

A team of experts from Britain has been visiting Northern Rhodesia to investigate the possibilities of a highly mechanised groundnut production on a large scale to combat the world fat shortage.

Considerable prospecting is reported to be in progress in the Ibadan area of Nigeria, where new areas are being opened up. Discoveries of talc are being worked and inquiries for tantalite have been received.

The military government of the American zone of Germany announces that the Allies have prohibited the use in future of the name of the I.G. Farben. and the trade mark of the trust on products manufactured in those of its plants to be maintained in operation.

Every effort is being made by the Soviet Russian authorities to exploit the mineral wealth of Sakhalin and the Kurile Islands.

The Battelle Memorial Institute, Columbus, Ohio, now has a staff of 860, and, according to the latest reports, did about $3,000,000 worth of research for industry during the past year. A convenient list has now been published, cataloguing and indexing the 819 books, publications and patents issued by the Institute during the period 1929-44.

Because the Italian Government has issued a decree providing for a 25 per cent. capital levy in the case of a capital increase carried out by means of a revaluation of assets, the board of the Montecatini group has decided to suspend, until further notice, the proposed increase of the capital from two to eight million lire, agreed upon at a recent extraordinary meeting.

Construction of an oil refinery near Valparaiso, Chile, is planned by the Corporación de Fomento de la Producción, the Caja de Nacional de Amortización and the Chilean State Railways at a cost of U.S. $10,000,000. It is intended that the plant, which will be designed for a capacity of 10,000 barrels daily, will be used to refine imported oil until production from the Punta Arenas oilfield becomes available.

Hitherto known mainly for its production of industrial inorganic chemicals, the Wyandotte Chemical Corp., Wyandotte, Michigan, is embarking on the manufacture of fine and organic chemicals. Two large plants, one turning out glycols, the other synthetic detergents, will be completed in the course of 1947. The capacity for manufacturing soda ash and calcium carbonate is likewise being greatly extended.

Paper manufacturers in Holland are reported to be suffering from a shortage of chemicals. Stocks received from Germany during the occupation are nearing depletion; salt cake used in making sulphate paper is in very short supply and sizing materials are badly needed. Some chlorine has been imported from Switzerland, but supplies are inadequate. A heavy demand exists for rosin from the United States, as European sources are restricted.

The erection of plant for the extraction of oil from the shale of the Gévaudan at Sévérac-le-Château (Aveyron) in S.E. France has aroused interest in the allied deposits in the district. An article by V. Charrin in *Chimie and Industrie* (1946, *56*, 1, p. 69) gives full details of these "pyroschistes," the average oil content of which appears to vary between 4 and 9.6 per cent., with an average of 6-6.8 per cent. (perhaps a rather optimistic figure). The oil-bearing seam at Sévérac is about 15 metres thick, and can be quarried from the surface.

Reconstruction work has begun on the oil refinery at Saint-Pol-sur-Mer, near the port of Dunkirk, which was totally destroyed in 1940. The new installations will allow the treatment of 900,000 tons of crude oil a year, against a pre-war capacity of 500,000 tons. The work will, it is hoped, be completed by 1949.

The Spanish textile firm, Peinaje e Hilatura de Lana S.A., of Tarrasa, near Barcelona, has applied for permission to erect a plant for the purpose of recovering the woo' grease and potash salts obtainable from the liquid residues of the wool industry. An annual production of 150,000 kg. is contemplated.

Forthcoming Events

October 2. North-Western Fuel Luncheon Club. Engineers' Club, Albert Square, Manchester, 12.30 for 12.45 p.m. Sir John C. Dalton: "Fuel Technologists and Nationalisation."

October 2. Institution of Works and Factory Managers (Midland branch). Queen's Hotel, Birmingham, 7 p.m. Mr. C. R. Jordan: "The Different Problems Arising in the Management of Small and Large Factories."

October 2. Society of Public Analysts. Chemical Society's Rooms, Burlington H u e, Piccadilly, London, W.1, 6 p.m. Mr. G. G. Freeman and Mr. R. I. Morrison: "The Determination of Some Products of Sugar and Molasses Fermentations"; Mr. T. G. Bonner: "The Estimation of Moisture in Propellant Explosives by an Improved Fischer Method"; Mr. A. H. Edwards: "The Analysis of Barium Carbide."

October 3. Oil and Colour Chemists Association (London Section). Royal Institution, 21 Albemarle Street, London, W.1, 6.30 p.m. Professor H. W. Melville: "The Chemistry of High Polymers—I."

October 3. The Chemical Society. Burlington House, Piccadilly, London, W.1, 7.30 p.m. Mr. J. M. Robertson and Mr. J. G. White: "The Crystal Structure of Pyrene: A Quantitative X-Ray Investigation;" Mr. R. F. Barrow, Mr. C. J. Danby, Mr. J. G. Davond, Mr. C. N. Hinshelwood and Mr. L. A. K. Staveley: "The Re-distribution and Desorption of Adsorbed Gases."

October 4. Society of Chemical Industry (Manchester Section). Lecture Theatre, Central Library, St. Peter's Square, Manchester, 6.30 p.m. Professor E. K. Rideal: "Physical Chemistry in the Dyestuffs Industry" (First Ivan Levinstein Memorial Lecture).

October 7. Oil and Colour Chemists' Association (Hull Section). Royal Station

Hotel, Hull, 6.30 p.m. Mr. G. H. Harries: "The Evaluation of Crude Petroleum Oils."

October 7. Society of Chemical Industry (London Section). Chemical Society's rooms, Burlington House, Piccadilly, London, W.1, 6.30 p.m. Dr. W. H. J. Vernon: "Chemical Research and Corrosion Control: Some Recent Contributions of a Corrosion Research Group."

October 8. Institution of Chemical Engineers. Geological Society's Rooms, Burlington House, Piccadilly, London, W.1, 5.30 p.m. Mr. D. G. Murdoch and Mr. M. Cuckney: "The Removal of Phenols from Gas Works Ammoniacal Liquor."

October 10. Oil and Colour Chemists' Association (London Section). Royal Institution, 21 Albemarle Street, London, W.1, 6.30 p.m. Professor H. W. Melville: "The Chemistry of High Polymers—II."

Occtober 11. Society of Chemical Industry (Chemical Engineering Group). Geological Society's Rooms, Burlington House, Piccadilly, London, W.1, 5.30 p.m. Mr. R. Scott, A.M.I.Chem.E.: "Chemical Engineering in the Tar Industry."

October 11. Society of Public Analysts (Physical Methods Group, jointly with Cardiff and district section of the Royal Institute of Chemistry and South Wales section of the Society of Chemical Industry). University College, Cathays Park, Cardiff, 6.30 p.m. Mr. A. D. E. Lauchlan: "Recent Developments in Apparatus for *p*H Measurement and Electro-titrations"; Mr. R. J. Carter: "Some Applications of Electrometric Methods of Analysis"; Dr. D. P. Evans: "Polarisation End Points."

New Companies Registered

Dytex (Scotland), Ltd. (418,791).—Private company. Capital £100 in 1s. shares. Manufacturers of and dealers in dyes and chemicals of all kinds, etc. Directors: E. Dee; B. Krenin. Registered office: Oxford Circus House, 245 Oxford Street, W.1.

Technotex, Ltd. (419,149).—Private company. Capital £1000 in £1 shares. Producers and manufacturers of and dealers in machinery, chemical goods, technical and chemical equipment, etc. Subscribers: A. Frigyes; S. Darvas. Registered office: 6 Bank Chambers, Station Road, Finchley, N.3.

Melwood Thermoplastics, Ltd. (418,901).—Private company. Capital £5000 in £1 shares. Manufacturers of and dealers in thermoplastic and plastic substances, materials, compounds and solutions, particularly polyvinyl chloride, polyvinyl acetate and polyethylene extrusions and mouldings, manufacturers of goods made of rubber, rubber-like substances and synthetic rubber, etc. Directors: F. K. Hollywood; A. W. Meldrum, 18 Old Park Ridings, Grange Park, N.21 (chairman).

Company News

The nominal capital of the **Morgan Crucible Co., Ltd.,** Battersea, has been increased beyond the registered capital of £4,237,000 by the addition of £350,000, in £1 "A" ordinary shares.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

JOHNSON & SONS MANUFACTURING CHEMISTS, LTD., London, N.W. (M., 28/9/46).—August 28, £15,000 debenture, to Abchurch Nominees, Ltd.; general charge. *£31,283. November 21, 1945.

Receivership

ANSOL CHEMICAL CO., LTD., 1 Broad Street Buldings, E.C.2 (R., 28/9/46.) E. C. Smith, chartered accountant, of 44 Brazennose Street, Manchester, was appointed receiver and manager on August 9, 1946, under powers contained in debenture dated May 7, 1946.

Chemical and Allied Stocks and Shares

STOCK markets were more disposed to move with the trend of Wall Street this week, and buyers showed a waiting attitude pending international developments. The Argentine, Brazilian, and French agreements helped sentiment, although Argentine rails lost part of last week's substantial gains. Strength was again displayed by British Funds. Industrials have been dull, prices losing ground owing to the small buying interest in evdence. Little selling was reported.

Imperial Chemical receded, but later firmed up to 42s. in anticipation of the interim dividend. Dunlop Rubber went back to 71s. 9d., and Courtaulds to 52s. 6d., while Turner & Newall were 85s., and

United Molasses 51s. 9d. Lever & Unilever firmed up to 54s., and Lever N.V. to 54s. 4½d. pending a statement regarding the Dutch company's dividend. Triplex Glass, awaiting the preliminary results, fluctuated around 40s. 3d., but there was a better trend in paint shares, helped by increases in recent interim payments. International Paint moved higher to £6⅝ xd on the increased interim. Paripan 5s. ordinary were 32s., the interim having also been raised in this case; while Pinchin Johnson, on hopes that the forthcoming interim may be stepped up, have touched 45s. 6d. Goodlass Wall at 29s. 9d. were also higher, and Lewis Berger firm at £6 11/16 in response to market dividend estimates.

B. Laporte were again 100s., Fisons changed hands around 60s., W. J. Bush were 90s., and British Drug Houses 55s., while British Glues & Chemicals 4s. ordinary attracted buyers and moved up to 16s. 3d. Monsanto Chemicals 5¼ per cent. preference were 25s., and Morgan Crucible first preference 28s. 9d. Greeff-Chemicals Holdings 5s. ordinary held firm at 12s. 6d. Blythe Colour 4s. ordinary were 46s. 3d., and William Blythe 3s. shares 13s. 9d., the latter remaining under the influence of the increased interim dividend.

Iron and steel shares lost part of their recent steadiness, the latest statements having indicated that, although postponed for the time being, the Government plans to nationalise the industry will operate during the present Parliament. Dorman Long were 26s. 4½d., United Steel 26s., and Stewarts & Lloyds 51s. 9d. On the other hand, colliery shares continued to be favoured on estimates of their break-up value and also on hopes of increases in forthcoming dividends. Powell Duffryn were 24s. 3d., and Bolsover 59s. Staveley moved higher at 55s. on further consideration of the strong position shown by the recently-issued accounts and the attractive yield on the higher dividend basis. Similar factors drew attention to Sheepbridge (46s. 6d.) the accounts having also been issued recently in this case.

Boots Drug eased to 60s. 4½d., and Beechams deferred at 26s. 3d. lost part of an earlier rally. Griffiths Hughes were 61s. Aspro also eased to 39s. 3d., but remained active awaiting the dividend announcement. Sangers held firm at 34s. 6d. Metal Box shares were 115s., and British Match 47s. 3d. Low Temperature Carbonisation 2s. ordinary showed activity around 3s. 7½d. Amalgamated Metal were 19s. 3d., and Imperial Smelting 19s. 9d. Oils, after earlier firmness, eased, but declines on balance were small, Shell being 92s. 6d., Anglo-Iranian 98s. 1½d., and Burmah 67s. 6d. xd. Trinidad Leaseholds and Trinidad Petroleum were well maintained, and there was activity up to 15s. 6d. in Mexican Eagle Oil on revived rumours of resumption of negotiations with the Mexican Government; but later the price fell to 14s. 7½d., subsequently recovering to 15s. Elsewhere, Distillers moved back to 132s. 6d. De La Rue at 12¾ lost the rise which followed official confirmation that the £1 shares are to be "split" into four of 5s. each.

British Chemical Prices

Market Reports

A FIRM tone characterises the London general chemicals market and there is continued pressure for deliveries against contracts. Buying interest has been spread over most sections of the market and export inquiry has been on a good scale. In the soda products section there has been a steady demand for the photographic and technical grades of hyposulphite of soda, while a persistent call for supplies of chlorate of soda and bichromate of soda is reported. Among the potash products both caustic and carbonate of potash are in good call, while permanganate of potash is firm on a good demand. In other directions a steady demand is reported for arsenic, formaldehyde, and the heavy acids, and there has been no falling off in activity in the lead compounds. Firm price conditions have been maintained in the coal-tar products market, with pitch in active request.

MANCHESTER.—A strong undertone remains a feature in virtually all sections of the Manchester market for both light and heavy chemical products, and in several directions the tendency is towards higher levels. The textile bleaching, dyeing, and finishing trades are all taking steady supplies under contracts, and these and other industrial users have been in the market with replacement orders. Export inquiries during the week have been on a fair scale, and additional business has been arranged. Most descriptions of tar products both in the light and heavy sections are being called for in good quantities.

GLASGOW.—There has been considerable activity during the past week in the Scottish heavy chemical trade, all classes of chemicals and raw materials being in great demand both for home and export trade, although available supplies are still insufficient to meet the demand.

Price Changes

Glycerine. MANCHESTER: Chemically pure, double distilled s.g., in tins, £4 16s. 6d. to £5 10s. 6d. per cwt., according to quantity; in drums, £4 2s. 6d. to £4 16s.

Lead Nitrate. MANCHESTER: £70 to £72 per ton d/d in casks.

Oxalic Acid. MANCHESTER: £5 to £5 2s. 6d. per cwt.

Salicylic Acid. MANCHESTER: 1s. 9d. to 2s. 1d. per lb. d/d.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Penicillin salts.—Commercial Solvents Corporation. 25190-1.

Coating compositions.—E.I. Du Pont de Nemours & Co. 24888.

Treatment of monofilms.—E.I. Du Pont de Nemours & Co. 25099.

Polyvinyl esters.—E.I. Du Pont de Nemours & Co. 25199.

Polyamides.—E. Ellery, and I.C.I., Ltd. 25096.

Insecticides.—J. Fechtner. 25255.

Copper base alloys.—J. G. Gaunt (Beryllium Corporation). 25296.

Pesticidal composition.—B. F. Goodrich Co. 25069.

Organic compounds.—J. D. Kendall and H. D. Edwards. 24735.

Ricinoleates.—E M. Meade and Lankro Chemicals, Ltd. 25014-5.

Insecticides.—Merck & Co., Inc. 24996.

Vitamin compounds.—Ortho Pharmaceutical Corporation. 24771-7.

Carbon black.—Phillips Petroleum Co. 25415.

Chlorinating plants.—Progil. 25109.

Polymers.—Ridbo Laboratories, Inc. 25420.

m-Aminophenol derivatives.—Roche Products, Ltd. (F. Hoffmann La Roche & Co.). 25332.

Formamide derivatives.—Roche Products, Ltd., A. Cohen and J. A. Silk. 25331.

Plastic films, etc.—Soc. Anon. des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny & Cirey. 25422.

Sulphur dioxide.—Soc. Anon. des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny & Cirey. 25422.

Hydrogenated oils.—A. H. Stevens (Armour & Co.). 25078.

Hydrocarbons.—Universal Oil Products Co. 25412.

Organic compounds.—Universal Oil Products Co. 25413.

Extraction of alkaloids, etc.—Usines Chimiques des Laboratoires Français. 25484.

Sulphur compounds.—Ward, Blenkinsop & Co., Ltd., A. A. Goldberg and H. S. Turner. 25282-3.

Sulphurised oils.—Anchor Chemical Co., Ltd., and K. C. Roberts. 26091.

Hydrocarbons.—J. C. Arnold. (Standard Oil Development Co.) 25868.

Nitro-compounds.—Boots Pure Drug Co., Ltd., J. Cymerman, and W. F. Short. 26179.

Cellulose derivatives.—British Celanese, Ltd 25830.

Polymers.—British Thomson-Houston Co., Ltd. 25834.

Carboxylic acids.—W. J. Bush & Co., Ltd., and H. W. Vernon. 25596.

Penicillin.—C. T. Calam, and I.C.I., Ltd. 25747.

Carboxylic acids.—Cilag, Ltd. 26001-3.

Penicillin.—Commercial Solvents, Ltd. 25787-90, 26323-28.

Extraction of casein from seeds.—Courtaulds, Ltd., and R. L. Wormell. 25746.

Tocopherol concentrates.—Distillation Products, Inc. 25906.

Vinylidene chloride.—Distillers Co., Ltd., C. A. Brighton, and J. J. P. Staudinger. 25597.

Streptomycin solutions.—Distillers Co., Ltd., P. D. Coppock, and A. G. White. 26322.

Ethylene oxide.—Distillers Co., Ltd., A. Dalgleish, J. B. Dymock, and D. R. Scarffe. 26321.

Vinyl ethers.—Distillers Co., Ltd., E. J. Gasson, D. C. Quin, and F. E. Salt. 2594?.

Organic condensation.—Dominion Tar & Chemical Co., Ltd. 25627.

Paraformaldehyde.—E.I. Du Pont de Nemours & Co. 25953.

Melamine resins.—J. H. Earl, Ltd., C. A. Redfarn, and R. E. Barritt. 25673.

Dyeing.—A. S. Fern, C. A. Pulley, S. M. Todd, and I.C.I., Ltd. 26339-46.

Carboxlic acid compounds.—B. F. Goodrich. 25945.

Thiazine products.—B. F. Goodrich. 26121.

Complete Specifications Open to Public Inspection

Continuous process for neutralising fatty acids.—Procter & Gamble Co. February 23, 1945. 1694/46.

Process for the manufacture of metallic carbides.—Régie Nationale des Usines Renault. May 16, 1940. 22279/46.

Manufacture of hard alloys.—Régie Nationale des Usines Renault. May 16, 1940. 22280/46.

Production of hard alloys obtained by fritting.—Régie Nationale des Usines Renault. May 16, 1940. 22281/46.

Preparation of alloys by fritting.—Régie Nationale des Usines Renault. May 17, 1940. 22567/46.

Process for the manufacture of fritted alloys.—Régie Nationale des Usines Renault. May 17, 1940. 22568/46.

Process for the treatment of magnesium and its alloys.—Régie Nationale des Usines Renault. September 15, 1941. 22569/46.

Process of separating alloys.—Spolek pro Chemickou a Hutni Vyrobu. July 8, 1940. 23210/46.

Preservation of organic materials.—M. Stern. August 5, 1944. 12135/46.

Catalytic reforming process.—Universal Oil Products Co. February 24, 1945. 5212/46.

Preparation of acetylpropyl chloride.—U.S. Industrial Chemicals, Inc. February 21, 1945. 33184/45.

Preparation of 5-diethylamino-2-pentanone.—U.S. Industrial Chemicals, Inc. February 21, 1945. 33185/45.

Heat-resisting alloys containing cobalt.—Allegheny Ludlum Steel Corporation. April 21, 1944. 23403/46.

Hard smooth craze-resistant surface coating.—American Cyanamid Co. March 2, 1945. 33049/45.

Resin for low-pressure paper base laminates and wood surfacing.—American Cyanamid Co. March 2, 1945. 34801/45.

Methods and apparatus for plying strands.— American Viscose Corporation. Feb. 23, 1945. 32865/45.

Production of phenolic resins.—Bakelite, Ltd. Feb. 27, 1945. 5859/46.

Production of cellulose derivatives.—British Celanese, Ltd. March 2, 1945. 5198/46.

Manufacture of azo-dyestuffs.—Ciba, Ltd. Feb. 27, 1945. (Cognate application 5998/46.) 5997/46

Process and apparatus for the production of melamine.—E.I. Du Pont de Nemours & Co. Feb. 28, 1945. 6268/45.

Electrolytic production of light metals.—E.I. Du Pont de Nemours & Co. March 1, 1945. 6411/45.

Production of chlorinated aliphatic nitriles.—E.I. Du Pont de Nemours & Co. March 2, 1945. 6412/46.

Polymeric materials.—E.I. Du Pont de Nemours & Co. March 1, 1945. 6413/46.

Non-corrosive sulphurised terpene products.—E.I. Du Pont de Nemours & Co. March 2, 1945. 6414/46.

Self-dispersing methylolamides.—General Aniline & Film Corporation. March 1, 1945. 4688/46.

Production of vitamin preparations.—Jiri Schicht akcova Spolecnost. Oct. 20, 1941. 22679/46.

Production of vitamin preparations and their related by-products. Oct. 20, 1941. 23680/46.

Bringing about physical, chemical and biological processes.—J. E. Nyrop. May 30, 1941. 23657/46.

Complete Specifications Accepted

Production of iron or steel alloys containing tungsten and silicon.—Climax Molybdenum Co. March 6, 1941. 579,927.

Polymerisation of ethylene.—E. I. du Pont de Nemours & Co. March 15, 1941. 579,881-2.

Process for the production of polymers and interpolymers of ethylene.—E. I. du Pont de Nemours & Co. March 15, 1941. 579,883.

Manufacture of high-molecular compounds.—E. I. du Pont de Nemours & Co. April 10, 1941. 579,884.

Compositions comprising polymers of acrylonitrile and shaped articles therefrom.—E. I. du Pont de Nemours & Co. June 17, 1942. 579,887.

Preparation of solid and semi-solid polymers of olefinic hydrocarbons.—E. I. du Pont de Nemours & Co. December 19, 1942. 579,894.

Production of vinyl cyanide.—E. I. du Pont de Nemours & Co. January 22, 1944. 580,035.

Manufacture of organic compounds containing fluorine.—E. I. du Pont de Nemours & Co., and P. L. Barrick. February 21, 1944. 579,897.

Anodes adapted particularly for use in the electrowinning of manganese.—Electro Manganese Corporation. January 16, 1943. 579,891.

Polymerisation of ethylene.—J. S. A. Forsyth, and I.C.I., Ltd. January 14, 1944. 579,938.

Process for the manufacture of derivatives of 3-oxy-4-hydroxy-thiophane and of their dioxines and osazones.—F. Hoffman-La Roche & Co., Akt.-Ges. July 2, 1943. 579,948.

Manufacture of solutions of decomposition products of saccharides.—Howards & Sons, Ltd., and R. H. Lock. July 22, 1941. 579,969.

Manufacture of lactic acid and salts thereof.—Howards & Sons, Ltd., and R. H. Lock. July 22, 1941. 579,970.

Dispersions of ethylene polymers.—I.C.I., Ltd. August 10, 1942. 579,889.

Polymerisation of vinyl acetate.—I.C.I., Ltd. July 13, 1943. 580,020.

Preparation of penicillin.—Parke, Davis & Co. November 23, 1942. 579,937.

Preparation of dithiol compounds.—J. D. Pratt, R. A. Peters, L. A. Stocken and R. H. S. Thompson. March 24, 1942. 579,971.

Distillation process for separating 3-Picoline, 4-picoline, and 2-, 6-lutidine.—Reilly Tar & Chemical Corporation. April 28, 1943. 580,048.

Polymeric materials.—Wingfoot Corporation. September 16, 1943. 579,899.

Recovery of caustic soda from black liquor obtained in the alkaline wood pulping processes.—Associated Pulp & Paper Mills, Ltd. April 27, 1943. 580,123.

Neoprene solutions.—B.B. Chemical Co., Ltd., and A. March. June 16, 1944. 580,190.

Rubber substitute.—H. A. Brassert & Co., Ltd., and F. Frank. June 12, 1944. 580,154.

Fractional distillation of hydrocarbons.—E. A. Coulson, and E. C. Holt. March 7, 1944. 580,102.

Polymerisation of olefines.—E.I. Du Pont de Nemours & Co. Dec. 9, 1942. 580,182.

The Chemical Age

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1423. October 5, 1946 Annual Subscription 21s. Overseas 26s.

Labour and Production

AMONG the facts that are common knowledge is the chronic shortage of everything that we need. It is difficult to find anything we desire to buy that is unrationed. If goods are not rationed officially, they are rationed by the shopkeeper who restricts his customers, or they are rationed by the producer who rations the shops by a "quota" out of which customers are served in rotation. If we ask why there is a shortage, we receive a variety of replies. The favourite one is that everything is being sold abroad. That is only a partial answer, however, because Sir Stafford Cripps, speaking in Edinburgh on September 19 last said that we are back to our pre-war level of exports—no more. Whether this means in value or in volume of goods we do not know, but we suspect it means in value, and therefore the volume of goods is considerably less. The labour force is not greatly less, however, because in the same speech Sir Stafford said that the number of workers available is about 20,000,000. Does the cause of the shortage lie in the decreased productivity of labour? Is the truth of the matter that the output per man-hour or per man-week is lower than it should be?

We are disposed to believe that a good deal of the shortage arises from that cause. In his speech, Sir Stafford Cripps said: "The most essential item of all (*i.e.*, for increased production) is good team work in factories. This can only come about if the workers are taken fully into consultation and are treated as intelligent partners rather than as brainless robots, as they have so often been treated in the past." We know beyond a peradventure that the technical staffs of factories and other production units are working as they have never worked before. Theirs not to strike or demand closed shops; theirs to burn the midnight oil. That being so, the only conclusion that we can draw from the reference to teamwork is that the workers are not pulling their weight. There is abroad in Britain a spirit of go-easy which is very disquieting, but which is to some extent the aftermath of the exertions made during the war. Until that spirit is exorcised and Britain turns again to work with a will, we shall not be prosperous, we shall not be able to afford to buy from abroad those things that we need to make life endurable.

Unfortunately, we are in a vicious circle that is difficult to break. While war tiredness may be part of the reason for the disinclination to work at full pitch, it is not the only reason. Technical men of all professions are intensely

On Other Pages

interested in their work, and to a large extent their work is their hobby. Whatever the conditions they will work hard because they cannot help it. For the hewers of wood and drawers of water the conditions are different. The great majority of people are not, like Becker's chemists, "impelled by an almost insane impulse to seek their pleasures among the soot and flame, poisons and poverty"; they labour because of the curse of Adam. If a man wants something badly enough he will work to get it. But when men see their earnings taken from them by the tax-gatherer, when they find that there is in the shops nothing upon which they can spend such money as is left to them, the will to work departs. The greatest fillip that could be given to this nation would be to provide the people with the goods that they want, and at the same time to reduce the level of taxation for all classes of the population—not the lower wage groups alone—so that the incentive to work may be restored. It is in our view the greatest argument against nationalisation and socialisation that they remove the incentive to work. The incentive that makes men work is ADVANCEMENT. Unless a boy or a man has the chance to "get on" in the world he will have little incentive to work hard. The reward that most men seek is wealth. Let us not delude ourselves about that. If it is rendered impossible for a man to grow rich, the incentive to enterprise is removed. The sturdy individualism of our fathers is being taken away from us; and nothing is being put in its place save the conception of a world wherein all are planed down to a dead level of income—and a low level, at that—with little or no hope of attaining a higher level by honest hard work.

Industry is a partnership between labour and capital. It is a partnership in which each has a part to play, but those parts are not interchangeable. We should like to have further information about what Sir Stafford Cripps means when he suggests that "team work can only come about if the workers are taken fully into consultation." It is obviously impracticable for factories to be run on the lines of a Soviet in which everyone has directly or through his representatives a say in the making of policy. The General does not consult his privates concerning military tactics; neither can the skilled business man be expected to consult upon questions of policy those who are inexperienced in the running of a business. On the other hand the relationship between all who are engaged in the work of any particular firm should be such that every man employed, from the highest to the lowest positions, regards the well-being of the firm as his particular care. The management should welcome suggestions on any subject, no matter from what quarter they emanate. Those who make these suggestions should be informed whether they have been accepted and if not for what reasons they have been rejected. The efforts of those who make suggestions should not go unrewarded. There are many directions in which the workman can be kept in touch with what is going on in the factory and can be given a hand in its organisation. The regulation of working conditions, safety measures, and many other things intimately concern everyone who is engaged in the works. If what we have said here is the meaning of Sir Stafford Cripps's reference to "consultation" we are entirely with him. Team work is essential for the running of any successful business, and suggestions received from experienced workmen as to how a job should be done, for example, must always be regarded with considerable respect.

Why is it that we are, in Sir Stafford's words, "gravely under-managed in most of our important consumer industries"? There is no doubt a disproportionate number engaged in certain trades, such as building, but we hardly think that accounts for the statement. The present shortages of goods are no doubt also due to the unfulfilled needs of the past few years. There have been notable increases in the rate of production. There is no doubt that when the present world hunger for goods of all sorts has been to a large extent assuaged, the present sellers' market will change to a buyers' market and we shall have to face competition. If production costs are too high then, we shall not sell our goods abroad. To lower production costs it is necessary to reduce taxation, to reduce labour charges, to reduce fuel costs, in short to operate our industries with a high degree of mechanisation and as efficiently as possible. In Sir Stafford Cripps's words: "Good quality of workmanship and design and reasonable prices will be needed if we are to maintain the volume of our exports." That is a call to technical men everywhere. It is necessary that we should now begin to plan against the time when the buyers' market will rule.

NOTES AND COMMENTS

The Heavy-Oil Subsidy

ON October 1 the subsidy of one penny a gallon on heavy oil comes into force, with the idea of continuing until the import duty at the same rate falls to be removed in next year's Finance Bill. This is an implementation of part of the recommendations made by the Ayre Committee last year, the full import of which we discussed at some length at the time (THE CHEMICAL AGE, 1945, *52*, 458). Since then the difficulty of the coal situation has been aggravated and the proportion of heavy oil used as fuel will be considerably increased as compared with that used for chemical synthesis. Indeed, annual consumption of fuel oil is expected to be more than doubled—say from about 1¼ million tons to 3 million tons. Nevertheless it is probably not altogether a coincidence that the formation of a new company to produce chemicals from petroleum should have been announced almost simultaneously. Matters have been "boiling-up" in that direction for some time now, and we have consistently advocated the extension of petroleum-cracking in this country. It may thus be that the final fillip has now been given to what may be an enormous and entirely new form of industrial development in Britain.

Soil Chemistry

WE have been reading with great pleasure, during the last few days, Dr. Dudley Stamp's book on *Britain's Structure and Scenery*, the latest addition to Collins's *New Naturalist* series. Apart from the fact that the book as a whole is a fascinating and thoughtful study of its subject, there is one section that must be of special interest to chemists, and that is the dozen or so pages concerned with soils. Naturally, in a book of this scope, the treatment is general, but there is a lot to be said for so clear and concise an exposition of the differences—physical and chemical—between soils, and the variation that they demand in treatment, from the point of view of utilisation. Dr. Stamp, it is well known, is deeply concerned with Land Utilisation, so that it is not surprising that he should show a thorough grasp of this subject; but we were particularly impressed by his views on the vexed question of "natural" against "artificial" fertilisers. He is not primarily a chemist, so that we were prepared for a little bias against "artificials." Happily, we were disappointed. Dr. Stamp adopts the attitude which we have always approved : that both natural and artificial fertilisers have their place, and that neither excludes the other. But, as he points out, what is a proper and excellent treatment for an English soil may be utter folly when applied, say, in West Africa. Britain has an amazing variety of soil within a very restricted area, and any generalisation is dangerous. For an exemplar of the scientific attitude to a highly complicated problem this chapter takes a lot of beating.

A Restoration Problem

WHILE on the subject of soil, it will not be out of place to call readers' attention to a small pamphlet issued by the Ministry of Town and Country Planning (H.M.S.O., 3d.). It is a summary of the Report on the Restoration Problem in the Ironstone Industry in the Midlands, and is numbered Cmd. 6906. Ironstone is a highly important raw material in the metallurgical industry of this country; and the problem is how to reconcile the winning of this material with the preservation of valuable agricultural land and, to put it bluntly, to prevent the creation of hideous and useless wildernesses. The report in question is a supplement to the Kennet Report of March 1939; like many another difficulty, this one was shelved during the war, and the solution has become no easier. The present report—temperate and well-thought-out—was made by Mr. A. H. S. Waters, V.C., D.S.O., M.C., a distinguished engineer. His main technical conclusions, briefly, are (i) that surface restoration must be considered as part of the ore extraction, and not as something requiring separate treatment; (ii) that developments in machinery, especially since 1945, make effective restoration much more feasible, concurrently with excavation; and (iii) that a legal obligation to effect a certain degree of restoration would lead to yet further beneficial developments in machine design and operation technique. The cost of the work, and the subsequent use of the land, are also fully examined. Some concerns have voluntarily carried out efficient restoration without this obligation; but human nature is such that this practice has been far from universal. We welcome Mr. Waters's findings, not only because they

seem to strike a fair balance between the claims of heavy industry and of agriculture, but also because they will lead to the employment of more skill in designing and more thorough-going efficiency in operation.

Chemical Control of the Potato

NOW that mashed potato powder is on the market in the Birmingham district, under the trade name of "Pom" we understand, renewed attention is being directed to the paper read before the Conjoint Chemical Bodies by Mr. Theodore Rendle at Bristol last November, in which details of the process of drying the potato and still maintaining its palatability were given in full. The material, we believe, is likely to labour under an unfair disadvantage, in that it will inevitably be likened to the dehydrated potato which was supplied in considerable quantities to our troops in Germany, and which did not meet with their favour. Complaints about the sliminess, or "gooey-ness," of the military product do not, however, hold good with the present material, provided that a little elementary care is exercised in its cooking. As Mr. Rendle pointed out originally, the mere addition of four times its weight of hot water (preferably 180°-200° F), with simple stirring, gives a ready-to-eat mash in less than a minute. The point is that the water must not be boiling. In quickness of preparation, this mashed potato powder is rivalled only by canned potatoes; dehydrated potato strips take considerably longer to prepare. Storage presents no commercial difficulties, and we are assured that the taste is quite satisfactory—almost identical, indeed, with the original. The great point in the manufacture is that, throughout, the whole operation calls for careful control and delicate adjustment, as can be seen from a perusal of Mr. Rendle's paper. This application of skilled chemical control to a new "universal" foodstuff is of great interest in these days of monotonous diet.

The Chemist as He Is

THE popular conception of a chemist as a white-gowned gentleman—a very young gentleman in some modern advertisements, but an old one elsewhere—gazing wistfully, pensively or earnestly at a liquid boiling in a test tube, may still linger in the minds of many people. It is fostered by the popular press, which appears to regard the white coat, worn not as a symbol of knowledge but for the sordid purpose of cleanliness, as a mystical shroud which automatically imparts learning and the appellation "expert" on the wearer. A rude jolt has been administered to this conception, partly with the spread of knowledge about the atom bomb, partly by young experimenters who have tried to hold test tubes of boiling liquid in unprotected fingers, and partly by the thousands of ordinary men and women who for the first time came in personal contact with chemists during the war. Another jolt will no doubt be administered when films about chemistry, mentioned elsewhere in this issue, are seen by the public.

Chemistry and Films

THESE films are included in the first list compiled by the Scientific Film Association of 595 films of general scientific appeal, with an appraisal of most of them. Superficially, it would appear that chemistry does not offer much scope for the film-maker, but the list of films on this subject indicates the wide range of choice that he has when the film producer enters the chemical field. Some of the films—especially those dealing with oil—have been made partly for publicity purposes. But this does not detract from their value. And if a few of the films appear elementary to specialists it must be remembered they may prove of great interest and educational value to those not engaged in that particular field. This list of scientific films follows the pioneer "Graded List of Scientific Films" compiled by the Association of Scientific Workers. We are promised future catalogues of specialist films as well as a catalogue of science teaching films.

STREPTOMYCIN

Addressing a press conference held on Tuesday by Boots Pure Drug Co., Ltd., at the London headquarters of the company in Stamford Street, S.E.1, Sir Jack Drummond, D.Sc., F.R.S., who is now director in charge of the company's scientific research, stated that the company hoped to have "reasonable quantities" of streptomycin available within six weeks, but a long time would elapse before large-scale production could be attempted. Production at first would be at the rate of about two kg. a month. He said the chemical structure of streptomycin looked like presenting the organic chemist with one of the most heart-breaking tasks he had known, because of the difficulty of synthesising it. Further details of the conference will appear in a subsequent issue of The Chemical Age.

Polythene*

Address in Paris by Dr. Freeth

POLYTHENE is a general term for the range of solid polymers of ethylene which are produced by subjecting that gas to high pressures under carefully controlled conditions. The polymer is a saturated straight-chain hydrocarbon in which the length of the molecules is of the order of 1000 carbon atoms.

A fairly full description of the properties of Polythene and some account of the difficulties met with in its production were included in THE CHEMICAL AGE in February last year (1945, *52*, 175). Dr. Freeth, however, provided a more detailed account, from the historical point of view, of the steps leading up to its manufacture, and also a more detailed summary of its properties and especially of its application to Radar.

Dr. F. A. Freeth, F.R.S.

History

In 1909, the Winnington laboratory of Brunner, Mond & Co., Ltd. (now the Alkali Division of I.C.I.), became interested in the preparation of ammonium nitrate by double decomposition; for example, ammonium sulphate + sodium nitrate giving ammonium nitrate + sodium sulphate. This type of reaction is one depending upon a knowledge of heterogeneous equilibria of the kind which had been worked out by Van't Hoff for the Stassfurt potash deposits, and some of the actual equilibria involved were then being worked out by Professor Schreinemakers of the University of Leiden. During the 1914 war many of the reactions for the preparation of ammonium nitrate were successfully put into operation and large quantities of ammonium nitrate were obtained thereby.

In 1919, contact was made with Professor Schreinemakers and Professor Kamerlingh Onnes of the University of Leiden. This led to a close association between the company's research department and the University of Leiden and, later, the University of Amsterdam, an association which still persists. Several of our young research workers went to Leiden and worked under Kamerlingh Onnes during which time some of them became acquainted with Dr. A. M. J. F. Michels of the University of Amsterdam, who at that time was a lecturer and has subsequently become van der Waals professor.

Dr. Michels was doing a great variety of work at very high pressures and several of our staff worked under his direction. He became one of our consultants and visited us frequently in Winnington. We owe a great debt to his scientific acumen, his experimental skill, and his extraordinary ingenuity. I should like specially to mention that when the isothermals of ethylene were measured by Professor Michels in Amsterdam his results were in extraordinarily close agreement with those of Amagat, obtained half a century ago, which reflect the greatest credit on the experimental genius of this great French pioneer of high pressure.

In 1928, I.C.I. (Alkali) sent out a small commission to visit Amsterdam where one of their staff was already working with Dr. Michels and decided on a programme of work at high pressures. In 1934, Dr. Michels designed at our request a pump capable of giving a pressure of 3000 atmospheres on a modified Cailletet principle which was built by Dikkers at Hengelo. It was with this pump and with apparatus designed by ourselves that we began systematic work on the high pressure chemistry of organic compounds during the course of which we eventually discovered Polythene in March, 1933. The above is the barest outline of the events which led up to the discovery of polythene and, as it were, the curtain is just going up. At that time at Winnington the research department was in charge of Mr. H. E. Cocksedge and polythene research was directed by Mr. J. C. Swallow. The original high pressure team were Messrs. M. W. Perrin, R. O. Gibson, E. W. Fawcett, and W. R. D. Manning.

The reader of the literature now growing on polythene from both sides of the Atlantic may possibly get the impression that important differences exist in the properties of polymerised ethylene from the two countries. Actually comparison shows that there are remarkably few, if any, differences between the products made in this country and America if equivalent grades are taken. The Americans favour a comparatively hard grade of Polythene while the cable industry

* Abridged from the English text of the French lecture delivered in Paris on September 23 by Dr. F. A. Freeth, F.R.S., of I.C.I., Ltd., at the 20th Congress of the Société de Chimie Industrielle.

in Great Britain prefers to use a composition plasticised with polyisobutylene.

The manufacturing position of Polythene to-day is as follows: considerable tonnages are produced from two plants in this country and from two plants in the United States, while plans for new plants and increased output are in active preparation.

Polythene is produced from ethylene obtained either from the oil industry or by the dehydration of alcohol. The Polythene produced in Great Britain is made from the latter. Alcohol vapour is passed over a catalyst at a temperature of 200°C. when it is decomposed into ethylene and water. The ethylene is purified with the utmost care and then carefully and accurately mixed with oxygen in a very small concentration. The mixture is compressed in two main stages at 1200 atmospheres and finally enters the reaction vessel, at 200°C. During the polymerisation a considerable amount of heat is developed and the removal of this has been the subject of ingenious design in the manufacturing plants. The liquid Polythene emerges from the reaction vessel in the form of a pellucid stream which is cast into blocks which are then ready for treatment for manufacture.

Properties of Polythene

Since it is the properties of Polythene that make it so valuable we can now enter into these with some detail. I would like to reiterate that the generic name Polythene covers a whole spectrum of products with gradations in properties, and it is our custom to select from the range the product with properties suited not only to the performance required of the finished article, but also to the processing methods available.

The outstanding electrical properties of Polythene and its low density could be matched in pure paraffin waxes, but in polythene they are combined with remarkable mechanical properties and, as a result, the virtues of the paraffin structure are made available in new fields of application. The new effects, particularly flexibility and toughness, are due to the long molecules which tie the structure together and, since we can control the average molecular weight, we can therefore control the mechanical and physical properties throughout our Polythene range, giving us a wide choice of materials. As frequently happens, it is necessary to compromise. For example, the material is usually processed as a thermoplastic. Now, while high molecular weight improves the properties desired in the finished article, it also causes great increases in resistance to flow when melted, and a limit is usually set by the capabilities of the processing machinery available.

The following are some of the principal physical properties. At 20°C. the power factor (tan d) varies between 0.0001 and 0.0003 and is practically independent of frequency from 10^3 cycles per second up to highest frequencies used technically, and the permittivity from 50 to 2×10^9 cycles per second is 2.3 at 20°C., which falls to 2.1 at 70°C. In fact, the electrical properties are what could be expected from its hydrocarbon structure. It has an active point between 110°-120°C. at which point all crystallising disappears. Its mechanical properties are typical of crystalline polymers in that it shows the property "cold drawing" in thin sections in the same way as gutta percha. The stress at which this phenomenone occurs is about 1500 lb./sq. in.

The compromise between high molecular weight and means of processing has so controlled the development of Polythene in Great Britain that varieties are classified on a scale based on fluidity in the molten state at 190°C. To enter into the details of this would require not one but a series of lectures, and I can only refer my hearers to papers such as appear in *British Plastics* in March, April and May of last year's issues under the names of Hunter, Oakes, Richards and Midwinter, and for scientific publications on the properties of the product as they are related to its structure to the publications in the Faraday Society, of which I have reprints here.

Resistance to Chemical Attack

Massive Polythene, such as sheets, films, coatings on metal, mouldings, and extruded sections, as would be expected, is chemically highly resistant and can be used extensively where such a property is of importance. It is however important to remember that it is a hydrocarbon and therefore liable to oxidation, although to a far smaller extent than rubber. Such oxidation can be inhibited by use of suitable antioxidants.

Halogens attack Polythene, but except at high temperatures the mechanical properties are not appreciably affected. It is remarkably resistant to acids and alkalis; 40 per cent. caustic soda is without action. It is extraordinarily resistant to hydrofluoric acid and suffers no mechanical deterioration. In air in the presence of ultra-violet light or strong sunlight there is a very slow discoloration and slow oxidation if no antioxidant is present.

Water Absorption and Diffusion

Polythene, being a hydrocarbon, absorbs water to a very slight extent, normally less than 0.05 per cent. Its resistance to permeability by water vapour is very good and it is one of the best of plastic waterproof film-forming materials, is comparable with rubber hydrochloride and moisture-proofed regenerated cellulose film, and is superior to polystyrene, rubber and cellulose esters. Paper or cardboard can be coated or im-

pregnated with Polythene and Polythene may be added to wax for use in waterproofing paper in order to raise the softening point and to improve the crease-resistance of the proofed paper.

When especially large or complicated articles have to be made, sheets and tubes of all grades may be joined by hot gas welding. A stream of nitrogen at 200°C. is directed on to the joint and a Polythene filler rod used to make the weld. In this way large containers for corrosive acids, pipes 3 or 4 ft. in diameter, T-pieces, flanged pipes, etc., may be fabricated. Polythene sheet may also be manipulated at a temperature of about 105°C. by bending and shaping over formers or by blowing with air at a pressure below 5 lb./sq. in. Polythene may be machined very easily, using ordinary wood-cutting tools and moderately high speeds.

Polythene in the War

The electrical properties of Polythene attracted the attention of the Services and of other Government Departments at an early date. In the I.C.I. the development of the applications of Radar was in the hands of Messrs. P. Allen and E. G. Willams. The pioneer of Radar in Great Britain, Sir Robert Watson-Watt, F.R.S., has been kind enough to give me the following statement on the matter. I now quote his words:

The introduction of Radar for fixed ground stations in 1935 led to an immediate and insistent demand for the design of mobile stations for land use, of shipborne sets, and for the fitting of complete Radar installations in combat aircraft. Difficult as were the ground and shipboard problems, they were easy compared with those of the airborne installations. High voltages are unpopular in the air, and an aircraft which must be parked in the open in all weathers, ready for instant action, is one of the least attractive platforms for equipment which on the one hand requires many kilovolts for its operation and on the other depends on a precise comparison of two very short-wave radio signals so weak as to be on the limit of perception at the moment when vital combat tactics have to be based on the comparison. Losses of energy had to be reduced to a minimum even when they were constant in value; variation due to moisture affecting differently the two sets of receiving aerials and the loads from them was fatal to directional accuracy. The airborne set could work effectively only on wavelengths under two metres and best of all on wavelengths under 10 cm. Orthodox dielectrics had intolerable losses or unacceptable mechanical limitations.

The availability of Polythene transformed the design, production, installation, and maintenance problems of airborne Radar from the almost insoluble to the comfortably manageable. Polythene combined four most desirable properties in a manner then unique. It had a high dielectric strength, it had a very low loss factor even at centimetric wavelengths, it could fairly be described as moisture-repellent and it could be moulded in such a way that it supported aerial rods directly on water-tight vibration-proof joints backed by a surface on which moisture film did not remain conductive; and it permitted the construction of flexible very-high-frequency cable. A whole range of aerial and feeder designs otherwise unattainable was made possible, a whole crop of intolerable air maintenance problems was removed.

So Polythene played an indispensable part in the long series of victories in the air, on the sea, and on the land, which were made possible by Radar. Polythene was an essential element in that "single technical device" to which the Fuhrer ascribed the "temporary" (but it proved, enduring) "set-back" experienced by his U-boats.

It made its contribution to the major naval combats typified by the action in which, as the Commander-in-Chief said, "find, fix, fight, and finish the *Scharnhorst*." It had its part in such continuing operations of the smaller naval craft as were delightfully summarised in one report "Our M.T.B.'s were enabled to detect the convoy, retire for a conference while they plotted enemy course and speed, deliver a deliberate and successful attack unobserved, and retire with the enemy still in doubt as to what had hit him." It had its vital place in the small batch of sets of anti-U-boat airborne Radar equipment which, with their shipborne counterparts—also Polythene-aided—permitted the sinking of a hundred U-boats within a very few weeks.

'And centimetric aerial systems in Polythene moulding multiplied the effectiveness of our bomber force by a very large factor indeed; the ruins of Hamburg and Berlin are a monument to a co-operation in which Polythene played a great part.

The A/B Cellul, of Karlstad, Sweden, has started on the construction of a rayon plant costing about 28,000,000 kronor. Production will be based on the method developed by the Industrial Rayon Corporation, the patents for which were acquired last autumn by Courtaulds, Ltd. The latter firm has recently transferred the patents for Sweden, Norway, Denmark and Finland to the Swedish Cellul company. The new plant will be built at Alvenäs in Värmland, and the output will include, in addition to rayon, material needed in the manufacture of motor tyres.

Monsanto Expansion

Large New Works Planned

A WELL-SITUATED site of 125 acres in the Newport development area has been acquired by Monsanto Chemicals, Ltd., for the construction of a large chemical works. Every endeavour is to be made to have the works in production early in 1938. Full-time employment will be available for between 500 and 600 local men.

Dr. L. F. Nickell, chairman of the company, stated in an interview that this Newport project is only part of Monsanto's £2,500,000 plans to expand their manufacturing and research activities, which have been well-established at Ruabon and Sunderland for nearly twenty years. The company has already allocated a large proportion for plant extension and the building of spacious research and development laboratories at their Ruabon works. A certain amount of this plant extension is now in hand. A start on the construction of the laboratories is scheduled for early in 1948 and, when completed, it is believed that they will be among the best equipped of their kind in the country.

Among the many benefits that Monsanto's proposal to go into production in Newport would bring to the area, one of the most important is that about 95 per cent. of the employees required will be men. Great importance is attached to this by the Newport Development Committee as the normal labour demand made by industries opening up in the development areas is for women operators. Another aspect of this Monsanto project that is causing great satisfaction is the increased use that will be made of Newport's excellent port facilities. It is expected that more than half of Monsanto's production at Newport will be available, directly or indirectly, for export.

A.B.C.M.

Branch Office in India

THE CHEMICAL AGE is informed by the Association of British Chemical Manufacturers that its plans for the establishment of a branch office in Bombay will now be advanced by an immediate personal visit by Mr. R. Murdin Drake, one of the managers of the Association.

Mr. Drake will be accompanied by Mr. A. St. J. Shuttleworth, who will act as manager of the branch office. Mr. Drake and Mr. Shuttleworth will as far as possible be arranging to meet in India all those who are interested in any way in the services which the branch office hopes to be able to offer. Their address for correspondence in the immediate future will be c/o Hongkong & Shanghai Banking Corporation, P.O. Box 602, Bombay.

Radio-Active Materials

New Research Station

A NATIONAL centre for the processing and distribution of radium, radon and artificial radio-active substances required for scientific, medical and industrial purposes, is to be established at Amersham, Bucks., as a Government establishment, operated by Thorium, Ltd. The extraction of radon, which, during the war was carried on at Barton-in-the-Clay under the Medical Research Council, will also be transferred to the new centre. Johnson Matthey & Co., Ltd., are voluntarily handing over to the new centre the whole of the business of filling radium into containers which they have conducted for many years.

Certain immediate additions will have to be made to the Amersham premises. It is expected that the work will expand considerably. It is intended to remove the centre to new premises when the shortage of building labour has eased, and it becomes possible to form a clearer view of the volume and scale of the work. The work, which will be closely integrated with the Ministry of Supply's activities in the field of atomic energy, will be controlled by a council which will include representatives of the Ministry, of the managements and of users.

Scientific Films

New Catalogue

THE "Catalogue of Films of General Scientific Interest available in Great Britain" compiled by the Scientific Film Association, has just been issued by Aslib (Association of Special Libraries and Information Bureaux). It contains the titles of the following films which may be of interest to chemists:

A.B.C. of Oil; Asphalt Lake; Chemical Work in the Centrifuge Cone; Chemical Work on the Microscope Slide; Coal—Scientific Methods of Coal Mining in the U.S.S.R.; Colloids in Medicine; Concerning the Crystal; Crystals; Damage Control—The Chemistry of Fire; Danger Area—Work on Explosives; The Discovery of a New Pigment; Distillation; Drilling for Oil.

Factory Fire Guard; The Film of Paint; First Principles of Lubrication; Furnaces of Industry; Handle with Care—The Chemistry and Manufacture of Explosives; How Steel is Made; How to Machine Aluminium; Industral Injuries; It Comes from Coal; Looking Through Glass; Making China; The Manufacture of Gas; The Mica Industry; Modern Steelcraft.

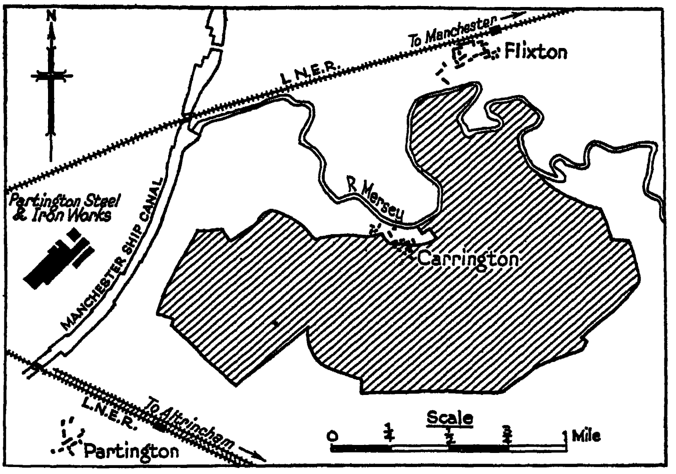
Oil from the Earth; Paraffin Young—The Work of James Young the Shale Oil Pioneer; The Production and Distribution of Medical Gases; The Production of Nickel; The Refining of Platinum and other Precious Metals; A Romance of Engineering.

Aromatics from Petroleum

New Works to be Erected

IN 1945 a company called Petrocarbon, Ltd., was formed to acquire from Dr. Ch. Weizmann the exclusive right to operate, under his patents, the Catarole process* in the United Kingdom and a great number of European and overseas countries. Catarole is the name given to a new process which makes possible the simultaneous production, from an essentially non-aromatic charging stock (such as naphtha or gas oil), of the whole range of the aromatic hydrocarbons in substantially pure form, and of a gas mixture containing a high proportion of olefines. A pilot plant for the development of the Catarole process has been working since 1941, to study the influence of operating conditions and of different charging stocks.

The shaded area indicates the site on Merseyside taken over by Petrocarbon, Ltd., for the erection of plant for the production of chemicals from petroleum. Sites will be available for factories using the raw materials provided.



Now it is announced that Petrocarbon, Ltd., have made financial arrangements for the construction of a large commercial plant to operate the process on a full industrial scale. Construction and operation will be undertaken by a wholly-owned subsidiary company, Petrochemicals, Ltd., under the control of Petrocarbon, Ltd. Initially, the new plant will have a capacity of 50,000 tons per annum of charging stock, but provision has been made for expansion to deal with an input of up to 100,000 tons yearly The most modern features of heat economy are to be incorporated, including use of back pressure turbines for the generation of power.

For the erection of the new plant, a site of over 700 acres has been purchased at Partington near Manchester. Sanction has been granted by the planning authorities for the industrial development of a large proportion of this area. The land runs alongside the Manchester ship canal and thus has direct access to ocean-going vessels *via* Liverpool. Further, such a situation places the plant in the centre of one of the most highly industrialised areas of England, with a large network of communications for efficient internal distribution. The site acquired is substantially larger than that needed solely for the Catarole plant. The intention is to provide space for the construction of plant by users of the basic raw materials which Petrochemicals will be producing. It is believed that Catarole will provide a nucleus around which other factories will be built, because it will provide many basic raw materials for the organic chemical industry.

The liquid reaction product from the Catarole process contains almost the complete range of high- and low-boiling aromatic hydrocarbons such as benzene, toluene, xylenes, ethylbenzene, styrene, alkyl-benzenes, naphthalene, alkyl-naphthalenes, anthracene, phenanthrene, fluorene, pyrene, and chrysene, all of which may be obtained in pure grades by azeotropic or fractional distillation and crystallisation, with only slight additional chemical treatment. Syntheses using aromatic hydrocarbons and olefines as starting materials (such as, for instance, the production of styrene from ethylene and benzene, or of isopropylbenzene from propylene and benzene) which have become an important feature of modern

* Weizmann and co-workers, B. PP., 552,216; 574,963; 574,973; 575,383; 575,766; 575,768; 575,769; 575,771.

chemical industry, can be carried through economically and with great ease because both components are available on the same site. Another favourable feature of the process is its flexibility: within certain limits it is possible to vary the proportions of the different chemicals produced, so as to suit changing market requirements.

All the products from the process are used in the manufacture of a wide range of commodities such as: paints and varnishes, dyestuffs, pharmaceuticals, photographic chemicals, synthetic fibres, synthetic rubbers, solvents, plastics, plasticisers, cosmetics, and insecticides. Also some of the products have uses either as solvents, heat media, or blending stock for engine fuel. The need for expanding home production of these materials has been recognised by the Hydrocarbon Oil Duties Committee and has been repeatedly stressed by a number of leading consumers. The raw materials of the Catarole process are primarily naphtha and gas oil, which are both in abundant world supply, and can be either imported or produced in refineries in this country. So flexible is the process, however, that other starting materials may also be used, such as shale oil or the coal oil from the low-temperature carbonisation of coal. The chemicals, solvents, spare parts, etc., required for the operation of the process are all available inside this country.

The provision for capital required for this project, including working capital, is about £1,800,000, and it is expected that the plant will be ready for operation in 1948. Mr. H. E. Charlton will be chief engineer in charge of construction. Thus, the research work started in the laboratories some 10 or 12 years ago by Dr. Weizmann and his co-workers—chief among whom was Dr. Ernst Bergmann—has been brought to a commercial stage by Dr. Franz Kind and in associated technical staff. Dr. Weizmann has agreed to act as head consultant to the undertaking and Dr. Bergmann will be technical consultant. It is intended that the research and development programme of both Petrocarbon, Ltd., and Petrochemicals, Ltd., will be on a considerable scale, and Dr. H. Steiner will be in control of these activities.

Directors of the New Companies

The board of Petrocarbon, Ltd., consists of: Mr. R. Ashton Hamlyn, O.B.E., F.C.A. (chairman), Mr. R. E. F. de Trafford, O.B.E., Mr. T. L. McC. Lonsdale, Dr. F. Kind, Ph.D. (Vind.) (managing director), Mr. G. Tugendhat, LL.D. (Vind.), M.Sc. (Econ.) (managing director), Lt.-Gen Sir W. G. Lindsell, G.B.E., K.C.B., D S.O., M.C., and Mr. M. A. Colefax. The board of Petrochemicals consists of: Mr. H. Stuart Ebben, O.B.E. (chairman), Lt.-Col. R. L. Benson, D.S.O., M.V.O., M.C., Dr Kind (managing director), Dr. Tugendhat (managing director), Lt.-Col. Sir W. G. Lindsell, and Mr. M. A. Colefax. Dr. Kind and Dr. Tugendhat for the last ten years have been largely engaged on the building up of the Manchester Oil Refinery group of companies, with which the Catarole project is closely connected. The London offices of the companies are at Adelaide House, London Bridge, London, E.C.4. The registered offices are at River Plate House, 12/13 South Place, E.C.2. The research laoratories are at Twining Road, Trafford Park, Manchester, 17, and the construction and development offices are at Clarendon House, 24 Clarendon Road, Eccles, Manchester.

Some account of the salient points of the Catarole process will be included in our next week's issue.

Individualist Luncheon

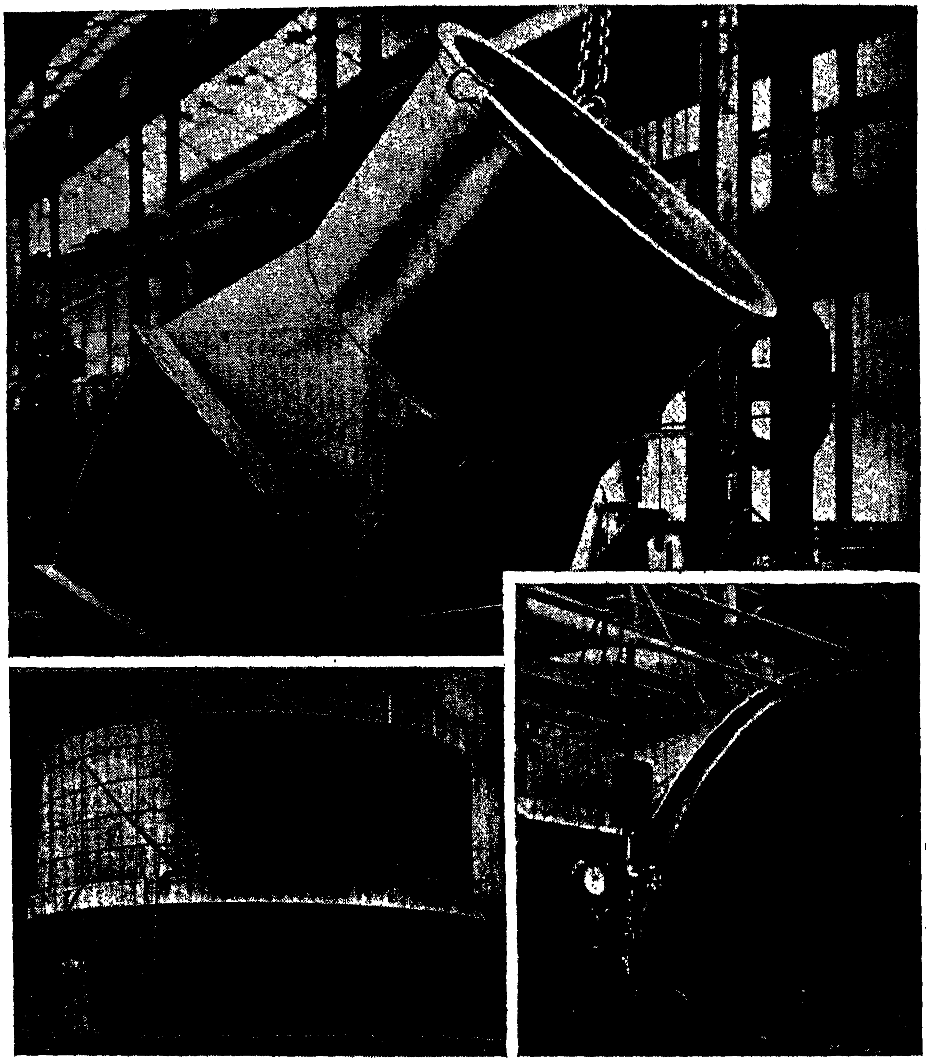
Captain Gammans Attacks the Government

AT a luncheon held by the Society of Individualists and National League for Freedom at the Connaught Rooms, London, on Thursday last week, Captain L. D. Gammans, M.P., made a slashing attack on the present Government.

Introduced by Sir Ernest J. P. Benn, Bart, C.B.E., president of the Society, who compared the present House of Commons, or two-thirds of it, to the pre-war Reichstag—"a solid, crowded phalanx, dumb, silent and determined"—Captain Gammans began with the assumption that his hearers agreed they had a thoroughly rotten and incompetent Government which had already done irremediable damage, and that the sooner it was got rid of, the better. In his opinion, there were "probably not half a dozen men on the Front Bench whom any business man would pay £500 a year." He doubted whether even the people in intimate contact with business realised how the commercial position of this country had deteriorated. During the war, we lost our overseas trade and much of it would never be recovered. We also lost the greater part of our overseas investments and to-day we owed £4,000,000,000 in the sterling area and that had gone up by £350,000,000 in the last six months. Last month we imported £120,000,000 worth of goods, but we exported goods worth only £77,000,000. After pointing out that nationalisation had failed, in the short run, to provide more coal, and that the loss of liberty was the biggest indictment against the Government to-day. Captain Gammans devoted the remainder of his speech to contending that if the Conservatives had been returned to power they would have done better than the Socialists, if for no other reason than that they could scarcely have done worse.

Metallurgical Section

Published the first Saturday in the month



SPIRAL GUIDED GASHOLDER—AUSTRALASIA

LANCASHIRE BOILER

Metallurgical Section

October 5, 1946

Ferrous Metallurgy in Russia

Recent Work on Cast Iron and Alloy Steels

by W. G. CASS

IN Russia as in other countries a distinction has long been drawn between the older or purely extractive metallurgy and the newer physical metallurgy. The term *Metallovedeni(y)e* is now often used to denote this latter, and is analogous to the German *Metallkunde*. During the past decade quite a number of books on physical metallurgy and metallography have been published in Russia, though it is still somewhat difficult to obtain copies. Among the most recent on physical metallurgy are those of A. A. Bochvar (1945), G. A. Kashchenko (1940), and N. F. Bolkhovitinov (1946). The last-named has become one of Russia's leading writers in this field, and has several earlier works to his credit, such as "Metallography and Heat Treatment" (1933), "The Research Department of a Tractor Factory" (1935), and "Grain Size and Properties of Steel" (1943). The following notes are based mainly on his latest book (1946) with some assistance also from a few scattered journal articles.

The exact title of Bolkhovitinov's latest is "Physical Metallurgy and Heat Treatment of Steels," though it also has a considerable section on cast irons, and the book, within the comparatively short compass of some 300 octavo pages, contains a wealth of information, tables, diagrams, and Russian official metal specifications; but it must be admitted that interest in American is far greater than in British metal research, for comparisons with American practice and specifications are frequent throughout the book.

The first three chapters deal with basic principles and the theory of alloys, with particular reference to iron-carbon alloys; and carbon steels form the subject of Chap. IV, including structure and properties, and special applications for cutting tools and stampings. Methods of manufacture, microstructure, and effect of alloying elements are dealt with in detail. The Russian specification for constructional steels, used for the most part without special heat treatment, is GOST 280/41, and for special heat-treated steels GOST V.1050/41. Manganese is an important element in the latter, and reference is made to the fact that, owing to the more plentiful supplies of manganese in Russia, that metal is more extensively used in steel manufacture than in the U.S.A. Later in his book the author points out that the converse holds in regard to molybdenum which is relatively plentiful in the U.S.A. and scarce in Russia. On the subject of comparisons between America and Russia, the view is also expressed that specifications in the former country are too numerous, having only slight differences between them (*e.g.*, in carbon content).

The manganese content of the special steels included under V.1050 is: 0.70-1.00 per cent. Mn in the 15G, 20G, 30G, 40G, 59G and 60G types; 0.90-1.2 per cent. in the 65G and 70G; from 1.20-1.60 per cent. Mn in the 10G2; and from 1.40-1.80 per cent. Mn in the 30G2, 35G2, 40G2, 45G2, and 50G2. Content of nickel or chromium does not exceed 0.30 per cent., that of phosphorus 0.045 per cent., and of sulphur 0.055 per cent. These are compared with the corresponding American (AISI-SAE) two series: (1) Martin & Bessemer steels, and (2) automobile steels, containing respectively 84 and 31 marks or grades, or 115 in all.

In the section of Chap. IV which treats of cutting tools and instruments reference is made to the Russian specification GOST V.1414/42 governing this class of steel, and comprising the A series (A12, etc.). A12 contains 0.08-0.16 per cent. C, 0.08-0.20 per cent. S, and 0.08-0.15 per cent. P, while A20 contains 0.15-0.25 per cent. C, 0.08-0.15 per cent. S, and not more than 0.06 per cent. P. These are the so-called automatic steels with relatively high sulphur and phosphorus content, used largely in Russia for agricultural machinery. They must be easily worked, and to this end the inclusion of some lead up to about 0.2 per cent. may be beneficial. This element does not enter into solid solution with iron. Aluminium and silicon should be avoided as alloying elements, since they form hard abrasive compounds which may play havoc with cutting tools.

Grey cast irons described in Chap. V are mainly governed by Russian specification GOST V. 1212/42, containing from 1.7 per cent. carbon. Their mechanical properties depend largely on graphitic formation, and

in discussing their micro-structure the author draws attention to the scale used by the ASTM and its formula. The above-mentioned specification comprises the "Sch" series, having a Brinell hardness of 143 to 241, and may be read in conjunction with the official standard (OST 26049) for graphic classification. Cast iron with extensive diffusion of large graphite grains shows a coarse-grained fracture, has comparatively low resistance to fracture, and reduced hardness.

According to OST 26049 graphite grains are classified as follows: G1, large; G2 medium; G3 small; G4 very small; G5 pinpoints. The large are above 300μ, the medium 150-300μ, the small 80-150μ. Other grades are G6 and G7, according to shape; and G8, G9, and G10 according to distribution. The following table gives mechanical properties of some Russian cast irons according to structural phase:

have many valuable properties and are widely used, *e.g.*, in the Ford crankshafts, and are more reliable than steel, as well as less liable to wear owing to easier lubrication.

On the subject of alloy cast irons, including white irons, the author considers the natural cast irons in Russia are of particular value, such as those of Orsko-Khalilovsk and Elizavetinsk. Those of the first-named place contain 3.25 per cent. chromium, 1 per cent. nickel, and 0.2-0.5 per cent. titanium, while the latter contain 1.1 per cent. chromium, 0.9 nickel, and 0.1-0.25 per cent. vanadium. They can, it is said, be usefully employed as additions in the manufacture of some cast irons to which they impart special properties. Additions of chromium and nickel, in fact, have been much studied in Russia in their effect on cast irons. The former tends to bring about a pearlitic structure, while nickel has a graphitising

TABLE 1

Structure element	Sp. gr.	Hardness (Brinell)	Tensile strength kg/mm²	Elongation %
Pure ferrite	7.86	60	30	40
Ferrite with 0.80% Si	—	90	40	30
" " 2.3% Si	—	124	45	25
" " 3.4% Si	—	150	55	20
Cementite	7.66	700–850	—	—
Lamellar pearlite	7.85	200–250	60–100	10–12
Ledeburite	—	650–800	—	—
Phosphorus eutectic	7.32	650–800	—	—
Manganese sulphide	4.0	—	—	—
Graphite	2.55	—	—	—

The official standard OST also includes a classification of the phosphorus eutectic according to the extent and nature of its diffusion. In discussing effect of various addition elements phosphorus indeed occupies an important place. In irons containing up to 0.5 per cent. P most of this enters into solid solution with ferrite; but where there is fairly high local concentration of phosphorus the small points of the phosphorus eutectic are very noticeable. The melt or flow point of this eutectic is 950-980° C.

The importance of graphitisation and control methods are considered at some length, including a reference to the use in the U.S.A. of the Michanite method patented by A. Michan. A silico-calcium flux, containing also some aluminium and iron, is used, so that calcium carbide is diffused throughout the cast-iron mass. The author adds that such an iron, when fractured, emits a smell of acetylene, which is hardly surprising if any moisture is present, occluded or otherwise. Control of graphitic centres may also be achieved, according to English workers, Norbury and Morgan, by use of a flux containing 0.2 per cent. titanium with blown in carbon dioxide. By subsequently blowing in hydrogen the titanium dioxide formed is reduced and very large graphitic centres are obtained. Graphitic cast irons of special structure

action and tends to produce a sorbitic form by modifying or reducing the pearlite. Reference is made to the three types of alloy cast iron used by Ford—chromo-nickel, copper, and chrome-copper—and a list of these is tabulated, the carbon content varying from 0.15 to 3.9.

Malleable cast irons are dealt with at some length. They are largely used in Russia where they are made from white irons following American practice. The manufacture of pearlitic malleable by the so-called European methods is now seldom seen in Russia even in the oldest factories. Following are extracts from relevant GOST specifications:

TABLE 2

Group	Mark	Tensile strength kg/mm², at least	Spec. elong %	Brinell hardness not exceeding
Ferritic (U.S.A.)	KCh 37–12	37	12	149
	35–10	35	10	149
	32–8	33	8	149
	30–6	30	6	149
Pearlitic (European)	40-3	40	3	163
	35–4	35	4	201
	30–3	30	3	201

It will be noted that the figures used in the mark correspond respectively to tensile strength and elongation percentage. In other cases the marks are designated by a group of initial letters and figures indica-

ting to some extent the elemental content of the material.

The interesting structure of white cast iron has been closely studied in Russia, and owing to the extra hard surface formed in this type of iron through rapid cooling it is being increasingly used in that country under a wide range of applications. K. P. Bunin and others have investigated the effect of graphite in white cast iron (*Trudy, Ural*, etc., 1944, *19*, 80-6). They state that the graphite content increases in proportion to the size of the ferritic grains formed by rapid cooling in ice-water; and also varied according to the temperature range, 1200 to 1500° C., at which the melt was kept for some minutes before cooling. Graphite content was lower, 0.06 per cent. at the higher temperatures. According to Doan and Mahla (*Principles of Physical Metallurgy*, 2nd ed.) rapid cooling in these white irons leads to the formation of Fe_3C crystals only, and there is little or no graphite.

Further, on the subject of graphitisation to which reference has already been made, it may be of interest to recall the paper on the chemical composition of malleable irons —often made from white iron by increasing graphitic structure—read by H. A. Schwartz before the American Foundrymen's Association early this year, in which he discussed among other things the conditions that alter response to graphite formation. The author found that the elements hindering this formation are chiefly Cr. Mn, and Mo, while those which favour graphitisation include B, P, Si, Ni, Co, Cu, etc.

In Russia, S. A. Saltikov has reported on the effect of rapid annealing of thin-walled castings in water or oil on graphitising. He found that the number of graphitic centres per sq. mm. after normal annealing was 20-25 but after a special accelerated treatment it was 120-2200, as revealed under a magnification of 130.

Steel Marks

It may be of interest at this stage to refer to the Russian method of indicating steel marks or brands in their specifications. To a limited extent the marks are descriptive and indicate the content of various elements in the steel. Thus Kh = chromium, G = manganese, N = nickel, Ph or F = vanadium, M = molybdenum, V = tungsten, Yu = aluminium, S = silicon, D = copper, K = cobalt, and T = titanium. These letters by themselves indicate at least 1 per cent. of the element, and are preceded by two figures to represent the carbon content (in hundredths per cent.), *i.e.*, 12 = 0.12 per cent. Therefore the mark 12KhN3A means 0.12 per cent. C, about 1 per cent. Cr and 3 per cent. Ni (A representing a sub-class or group). This method of marking is compared with the American AISI-SAE which have closer limits of carbon content and are probably more convenient in this respect.

But this nomenclature is only very approximately descriptive, and is not always strictly followed. For example, we have the mark 15KhPh = 0.15 per cent. carbon, about 1 per cent. chromium, and 0.2 per cent. vanadium, in which the last-named, though present in such low concentration, is yet included in the mark; whereas in 50KhN (containing percentages of 0.45-0.55 carbon, 0.50-0.80 manganese, 0.45-0.75 chromium, and 1.00-1.50 nickel) though containing therefore less chromium than manganese yet includes the chromium but not the manganese in the mark. These manganese constructional steels are divided into two groups (1) modified steels, and (2) high-modified steels, the latter having an A at the end of the mark.

They all contain 0.15-0.30 per cent. silicon except in 30KhGS which contains 0.90-1.20 per cent. Si, while the sulphur and phosphorus limits are 0.05 and 0.04 per cent. respectively. Carbon percentage ranges from 0.10 to 0.55; manganese from 0.25 to 1.20; chromium from 0.60 to 1.75, and nickel from 0.10 to 4.60 (the higher Ni content is mainly found in the second or A group). This second group includes members with varying additions of molybdenum, tungsten, or aluminium (0.15 to 1.25 per cent.).

Heat Treatment

As in other countries, much research in Russia is now concentrated on heat treatment of various steels, and this indeed forms the sub-title of Bolkhovitinov's book. By way of example, it may also be added that I. E. Brainin (*Stal.*, 1945, 67-77) has recently investigated the thermal treatment of 38KhMYuA, which appears to be the same as the 35KhMYuA included in the tables above-mentioned (in which the carbon content ranges from 0.30 to 0.38 per cent.). In regard to the effect of preliminary heating on crystal growth, mechanical properties, and the appearance of a stone-like fracture in this steel, it was found—as might indeed be expected—that crystal growth is a direct function of temperature of preheating. Intensive growth of grains started at 1000° C. There was no relation between preliminary heating and impact strength; but the smaller the molybdenum grain size the greater the impact strength. The value of impact strength and its determination, as a measure of the quality of steels, has lately been discussed by N. N. Davidenkov in *J. Tech. Phys. U.S.S.R.*, 1945, *15*, 310-317; and the effect of aluminium in iron by A. T. Grigor'ev of the Inst. Gen. Inorg. Chem. at Moscow.

The low-alloy steels of which the composition has lately been published include the so-called DS (Dvortsa Sovet or Soviet

Palace) steel, and the Kortem, Manten, Miari P, and Naks steels, containing from 0.10-0.30 carbon, 0.5-1.6 manganese, 0.3-0.7 copper, about the same for chromium, while some contain a little nickel; phosphorus is limited to 0.12 in Miari P, and much less in the others.

Special-purpose steels are being developed in Russia for agricultural machinery, notably tractor engines and parts, for cutting tools, and also for stampings. Among instrument (and cutting-tool) steels are included both the plain carbon type and alloy steels, in which the chromium group predominates—chromium, chromo-silicon, and chromo-manganese. In some cases, as in the Kh12 and Kh12M specifications, the chromium content, as indicated in the mark, is 11-13 per cent., and these steels are subjected to special heat treatment, including annealing in oil or air at 975-1030°C.

Stamping Steels

Steels for shaping and stamping are also growing in importance in the Soviet Union, and these, too, are mainly of the chromium type. Some of the marks are: 6KhNM, 5KhGM, 4KhS, 6KhS, 4KhVS, 7Kh3. As will be seen the carbon content ranges from 0.04 to 0.07 per cent. while the chromium may be up to nearly 4 per cent.; for in the last one, though chromium is given as 3, the actual content of this element is 3.2 to 3.8. No. 5 in the above list (4KhVS) also contains 2.0-2.5 per cent. tungsten, and although M is included in the first two marks the actual percentage of this element (molybdenum) is only 0.15 to 0.30. In addition to these are several other special steels (27 marks in all) used for stampings and forgings, including 5KhNM, 3KhV8, 5KhVS, KhG, Kh12, and Kh12M. The high tungsten content of the second will be noted. The three marked 6KhNM, 5KhNM, and 5KhGM are largely used for hot stampings. They have deep tempering or annealing properties and permit isothermic or uniform annealing, to an appreciable depth, of stampings of large section, as shown by the various S curves which have been prepared.

In the high-speed cutting steels group the system of marking with significant letters and figures is not apparently used. These steels are designated as RPh1, R18, 18-4-1, etc., containing 0.70-0.80 per cent. C, 17.5-19.0 per cent. W, 1.1-1.4 per cent. V, 3.75-4.5 per cent. Cr, 0.5 per cent. Mo. The cast steels have a carbide structure in the eutectic which, with mechanical and thermal working, changes into grains or crystals of varying length. The structure of forged or similarly treated high-speed cutting steels consists, to the extent of about 30 per cent. of complex carbides of the type (Fe, W, Cr, V)$_6$C, and about 70 per cent. of ferritic alloy. Some of these steels are also classed as low-alloy steels, with the EI class mark, with the following composition (two American are included for comparison):

TABLE 3

Mark	C	W	Mo	Cr	V
EI 184	0.80–0.95	4.5	—	7–9	1.0–1.4
262	0.85–0.95	8.5–10	—	4–4.6	2–2.6
290	0.90	3	3	4	2
U.S.A.	0.75–0.90	5–6	3.5–5.5	3.5–5	1.25–1.79
„	0.80–0.90	5–6	1.2–1.5	4.2–4.8	1.4–1.6

Research on hard alloys and metallic carbides (metallo-ceramics) is extensively pursued in Russia as elsewhere, in view of the great and growing importance of these products, and despite the increasing attention now given to synthetic gems of the alumina (corundum) form. In Russia they are known as the Pobedit or Victory type, RE series, with the usual cobalt matrix or binder, alone or with a little molybdenum. In the RE-3, -6, -8, -12 and -15 series, the cobalt content is given by the mark figures (3 per cent., 6 per cent., etc.), the balance being tungsten carbide; but Pobedit alpha 21 contains 8 Co, 68 WC, 21 TiC, and 1 Mo, and P-alpha 15 contains 5, 78, 15, and 1 respectively. Sergonit 82 is practically the same as P-alpha 21 except that it contains 69 tungsten carbide and 20 titanium carbide. Since cobalt is somewhat scarce in Russia it is sometimes replaced by nickel, and these hard alloys are then called REnicks. The cast hard alloys usually contain from 13.5 to 35 per cent. chromium, with varying smaller amounts of Ni, Mn, and Si, or fairly considerable amounts of Co and W, and bear the names Sormite No. 1, Sormite No. 2, Stalinit, and Stellit.

TABLE 4

	Sormite No. 1	Sormite No. 2	Stalinit	Stellit
C	2.5–3.3	1.5–2.1	10	0.5–2
Cr	25–31	13.5–17.5	18	29–35
Ni	3–5	1.5–2.5	—	
Mn	0.5–1.5	0–1.0	15	—
Si	2.8–4.2	1.5–2	—	—
Co	—	—	—	35–55
W	—	—	—	0–15
Fe	55–67	74.8–81	57	4–13

A trade agreement has been signed between France and Turkey for the exchange of goods to the total value of 1,500 million francs within the next twelve months. France will supply chemicals, chemical products, optical and precision instruments, serums and vaccines, pharmaceutical specialities, etc., in exchange for chrome ore, antimony, pitchblende, tanning extracts, copper, etc.

The well-known French journal, *Bulletin des Matières Grasses*, issued by the Colonial Institute at Marseilles, is now to be published under the aegis of the Institut de Recherches pour les Huiles de Palme et Oléagineux, and will be entitled *Oléagineux*. The subscription charge will not be changed until 1947, and the subsequent rate remains to be announced.

Tin Prices Settled

Increases Announced

THE Ministry of Supply has announced new selling and buying prices for tin. The basic price of tin metal sold by the Non-Ferrous Metals Directorate for delivery in the U.K. has been increased from £300 to £380 10s. a ton. At the same time the basic price of tin metal sold f.o.b. U.K. port for export from the U.K. has been increased from £357 to £380 10s. The basic price is for metal of minimum 99 per cent. to 99.75 per cent. tin content, and prices for all other grades have been varied correspondingly.

The selling price of Straits tin for export is raised from £351 to £372 a ton ex works Penang/Singapore. Further inquiries on these selling prices should be addressed to the directorate of Non-Ferrous Metals, 20 Albert Street, Rugby.

Settlement has now been reached on the purchase price to be paid by the Ministry of Supply for tin concentrates in Malaya, Nigeria, and East Africa. In the case of Nigeria, where the costed contracts with the main producers were terminated at the end of 1945, the price for the first half of 1946 has been fixed at £340 a ton of tin in ore f.a.s. Nigerian port (the Ministry paying ocean freight and insurance and smelting charges). The prices paid in East Africa will be adjusted generally to the new Nigerian levels. In the case of Malayan concentrates the basic tin price from July 1 is £370 a ton at Penang/Singapore smelters.

Stabilised Steel

Royalty-Free Use of U.S. Patents

ALL patent rights in a "stabilised" steel composition designed to meet requirements of increasingly high temperatures in power plants and in the chemical industry have been allocated to public use by the United States Steel Corporation and Carnegie-Illinois.

The use of the material was patented by Dr. Marcus A. Grossmann, director of research, and Dr. R. F. Miller, development engineer, stainless and alloy steels, of Carnegie-Illinois. The patent relates to "the use of a grade of steel particularly resistant to graphitisation when subjected to stress in the temperature range from 800° to 1100° F. According to the patent, the steel alloy developed for this service is of a carbon-molybdenum-chromium composition. The steel embraced in the patent now made available to public use is of the pearlitic, non-air hardening type containing from 0.08 to 0.20 per cent. carbon and from 0.45 to 0.65 per cent. molybdenum in conjunction with from 0.15 to less than 1.0 per cent. chromium, which is proportioned with respect to the carbon content to fix substantially all the carbon in the form of carbide, which is stable within the defined temperature range. It is not only more stable from the standpoint of graphitisation and spheroidisation, but also has a strength equivalent to that of the carbon-molybdenum steel previously used.

NO ALUMINIUM SHORTAGE

At a luncheon given at the Dorchester, London, last week, by the aluminium industry in honour of Sir Edwin Plowden, chief executive of the Ministry of Aircraft Production during the war, Mr. Horace Clarke, president of the Aluminium Development Association, said that recent reports of an aluminium shortage were completely unfounded. If there was a shortage at all it was a merely local shortage of labour. They were fortunate in comparison with other metal industries in that they had ample plant capacity and an adequate supply of the base metal.

ALUMINIUM PRODUCTION

Production of virgin aluminium (all unwrought forms) in the U.K. was slightly lower in the second quarter of 1946 at 8068 long tons, as compared with 8264 tons in the first quarter, according to the Ministry of Supply.

With secondary ingot, excluding recovery from crashed aircraft of 9856 long tons, against 10,358 tons (corrected figure) in the first quarter, total production was 17,924 tons, against 18,622 tons. Scrap yielded 14,924 long tons, compared with 13,765 tons, while consumption was 14,184 tons, against 13,004.

U.K. TIN POSITION

In a summary of the U.K. tin position, the Ministry of Supply notes that stocks in its possession at August 1 were 9658 long tons, to which must be added 2289 long tons produced, making 11,947 in all. Of this, 2680 tons were delivered by way of export, leaving a stock of 9267 tons at July 31.

Consumers' stocks at August 1 were 3498 long tons. Adding deliveries, 2431 tons, and subtracting consumption, 1885 tons, the calculated stock at August 31 was 4044 tons. Actually, 3771 tons were reported held in stock by consumers at that date.

Tin ore (tin content) in stock in the U.K. at August 1 was 6935 tons at August 31, 9049 tons.

Australian tungsten ore has been purchased by France. The Commonwealth's pre-war output was 1000 tons of ore per annum, but it has been increased materially during the war.

Canadian Metal Output

Figures for First Half Year

ACCORDING to a preliminary estimate, especially prepared for our contemporary, *The Mining Journal*, Canada's production of copper, nickel and zinc declined during the first six months of this year, while output of lead, of which metal there is a world shortage at present, has shown an increase. Copper output is estimated at 188,000,000 lb. compared with 258,000,000 lb. in the same period of 1945. Output so far has been about 11,000,000 lb. per month below that of last year. Nickel production registered a serious decline, but during the final months of the first half, a slight recovery was noticeable. Output estimates of 100,000,000 lb. are some 40,000,000 below the 1945 figure. However, a favourable feature of the position is the gradual decline in stocks resulting from war production.

The decline in the production of zinc has been less pronounced; while the monthly average last year was about 46,000,000 lb., an average of 41,000,000 has been reached this year. Lead output has shown an increase with an estimated 188,000,000 lb. for the first half of 1946, as compared with about 168,000,000 lb. last year. Current production of platinum by the International Nickel Co. is estimated at 80,000 oz. a year, comparing with 150,000 oz. for 1945.

PAINTING OF STEEL

The British Standards Institution has issued P.D. 539 : 1946, "Recommendations for Phosphate Coatings as a Basis for Painting Steel," as an interim measure for the assistance of industry. Instructions are given on the method of application of satisfactory coatings and elementary tests of the suitability of the coating are described. Research is now in progress and it is intended to prescribe performance tests as soon as sufficient data is available. Copies of the recommendations may be obtained from the B.S.I., 28 Victoria Street, London, S.W.1 (price 1s.).

REFINING BRASS SCRAP

The Ministry of Supply has entered into arrangements with copper refineries in the U.S. and Canada under which the Ministry will ship for treatment during the next 15 months about 148,500 tons of brass scrap and the refineries will return the copper content as electrolytic copper. The brass scrap is mainly 70/30 ammunition scrap and ingots cast from ammunition scrap. The Ministry expects about 100,000 tons of copper to be returned to this country. The bulk of the contracts have been placed with U.S. refineries.

METAL NOTES

The possibility of establishing an iron and steel industry is being studied by the Egyptian authorities. It would be based on occurrences of iron ores in the Aswan region.

Production of bauxite in Hungary totalled 18,000 tons in the first five months of 1946, equal to an annual rate of 8 per cent of the record production of 1943. Manganese ore output for the first six months totalled 6100 tons, about half the peace-time figure. In the same period, 400 tons of lead ore and about 14,000 tons of copper ore were produced.

Copper consumption in the U.K. during August again showed an increase, the total of 46,827 long tons being 4043 tons above the July total and 7247 above the June total. Unalloyed copper products accounted in August for 21,363 long tons, and alloyed products for 22,681 tons. The balance of 2783 tons was used for copper sulphate.

Iron ore production in Algeria is recovering from the effects of the war; output in June amounted to 125,000 tons, compared with 120,000 and 15,000 tons at the end of the two previous years. Because the Ouenza loading plant was destroyed by enemy action, no increase in exports is likely to take place until it has been replaced. Reserves of high-grade ore are said to be extensive, and efforts are being made to improve methods of production.

Though the occurence of nickel in Spain has been known for a long time, it has never been mined. In recent years, however, the deposits at Carratraca (Malaga) and at Vimbodi (Tarragona) have been exploited, output for the years 1942 to 1944 having totalled 1624 tons of nickel ore, with a mean content of 4 to 7 per cent. The ores are concentrated in the washing plant at Carratraca up to 38 per cent. and two smelting units at Bilbao have yielded mattes and speiss of over 40 per cent. nickel. Spain's domestic nickel needs are estimated at 350 tons yearly.

New Automatic Pipette

Double-Action Precision Instrument

by I. C. P. SMITH, B.Sc., F.R.I.C.

THE principle of a hypodermic syringe in conjunction with a three-way stopcock has already been employed as an automatic pipette for handling serum, etc. (Ayling, *Brit. J. Exp. Path.*, 1924, p. 354), the movement of the plunger being controlled by an adjustable screw stop. Two non-return valves have been used in place of the stopcock. While these pipettes could be calibrated by the user and the screw locked in position, they are not capable of being calibrated or certified by an independent body. The syringe or pump action has, however, many advantages over the ordinary pipette, notably in speed of delivery, as there is no consideration of delivery or drainage time, nor is there an adherent drop to be touched-off from the jet, as the speed of the emergent column of liquid is so high, right up to the moment of cut-off, that this drop is not formed. Once, therefore, that the piston has covered its given stroke, the volume has been delivered with great accuracy of reproduction, and if the piston can be made to work between fixed, *e.g.*, glass, stops, the one disadvantage of the screw adjustment can be overcome.

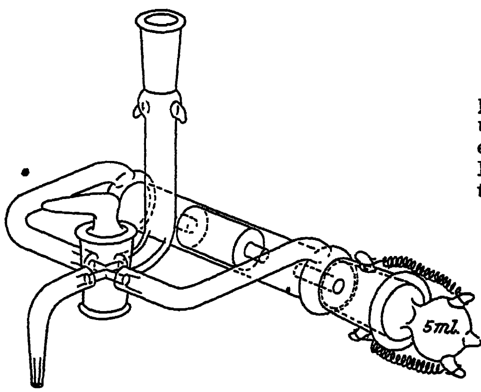


Fig. 1.

The D.S.I.R. pipette, which is purely hand-operated, is one solution of the problem, and another is the double-action automatic pipette which is the subject of the present article.

The pipette is shown in two arrangements in Figs. 1 and 2. Fig. 1 has a four-way stopcock and a 90° movement of the key, and is arranged for attachment to a reservoir by standard-ground joint; while Fig. 2 fits directly, again by standard-ground joint, into the tubulure, as shown also in Fig. 4; it has a 120° key-movement. In either case a delivery is made each time the tap is given its prescribed turn in either direction.

The action of the pipette, it will be seen, depends on the movement to and fro of the piston, which is closely fitting in the barrel, under the pressure of the liquid. On reference to Fig. 3, which represents the form Fig. 1, it will be seen that when the tap is turned to the left, as in (*a*), liquid from the reservoir above, *R*, drives the piston from the left-hand end of the barrel to the right-hand stop attached to the stopper, at the same time forcing under the same pressure-head a volume of liquid before it out of the jet, *J*, the volume being measured by the distance travelled and the piston area. On turning the tap 90° to the right as in (*b*), the movement is reversed; the piston moves to the left, again forcing the measured column of liquid before it out of the jet at *J*. The working positions of the handle of the key are shown at 45° left and right of the jet tube, there being a fully "off" position midway between these over the jet. It will also be apparent that with this type of stopcock the key could be turned 90° at a time in one direction, stopping at each of the similar positions and giving the measured discharge at each.

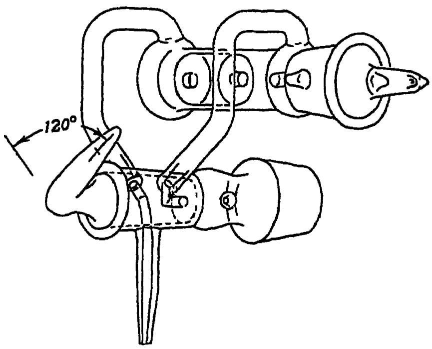


Fig. 2.

The action of the form Fig. 2 is similar to that of Fig. 1, but here the tap movement is 120°, and the handle is in line with one or other upper arm when making a delivery. When the handle is turned down into line with the jet, the aspirator is connected directly with the jet, a useful adjunct for

taking bulk solution, swilling through the jet before using, etc. The stopcock is very robust in construction, being formed in one piece with the cone, and the metering device is in a well-protected position above it. This does not, of course, prevent the aspirator from emptying down to the usual limit at the tubulure. It may be an advantage with this form to apply air pressure to speed operation. With either form of apparatus metal stops may be provided to locate the working positions of the handle; hooks and springs are also required at all joints, and a clip to hold in the key.

Certain details concerning the piston and barrel should be noted; the piston must fit closely, following hypodermic syringe practice, the clearance being of the order of 0.0002 in. No lubricant or sealing device may be used, hence slight leakage may take place past the piston; it is allowed for in the calibration, but for this reason the tap should be turned to an " off " position when out of use. Owing to the close-fitting piston, liquids must be carefully filtered, preferably through sintered glass, and a filter-tube provided to the top opening.

The barrel may be precision-bore or ground out, according to manufacturing preference, but the former is preferable in order to standardise calibration; the flat end forms one stop for the piston, while the other takes the form of a projection or rod on the stopper; all the stops are ground perpendicular to axis at their tips. The final adjustment for volume is obtained by grinding down the length of the stop attached to

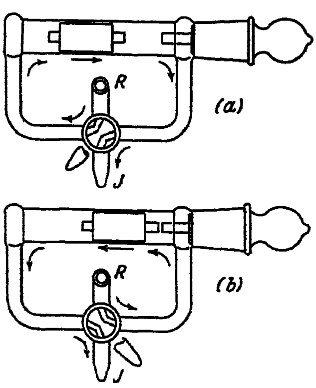


Fig. 3

the stopper. An important point is that by employing standard grinding, stoppers with different lengths of rod may be supplied with one apparatus, the volume being marked for convenience on the stopper. The barrel has a swelling at each end to clear the bore, and the tubes running from the barrel to the stopcock are taken off the tops of these in order to facilitate the removal of air-bubbles when starting up. Fig. 4 shows a pipette complete with aspirator and four extra stoppers, variously calibrated.

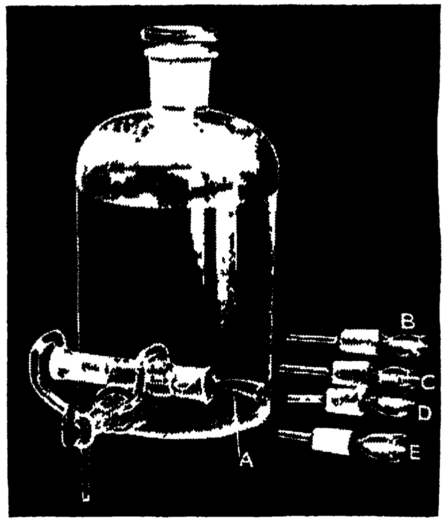


Fig. 4. The pipette complete with aspirators and extra stoppers differently calibrated. (A=10 ml., B=11 ml., C=9 ml., D=5 ml., E=4.5 ml.)

The speed and reproducibility of the pipette are shown by the following test which was carried out by the N.P.L. under controlled conditions: A pipette calibrated for 5 ml. was set up under a head of 24 in. of water. Six receivers were prepared and 6 deliveries made; from the beginning of the first to the finish of the sixth, these took 31 sec. The amounts delivered corrected to 20° C. were:—

4.987 ml.	5.002 ml.
4.986 ml.	5.005 ml.
5.013 ml.	4.996 ml.

The maximum error is seen to be 0.014 ml. N.P.L. Class A tolerance for 5-ml. bulb pipettes is 0.02 ml. The delivery and drainage time of the latter amount to about 30 sec., in addition to the time taken in sucking up and adjusting.

The pipettes have so far been constructed for 25 ml. as an upper limit, and 0.5 ml. as a lower limit of capacity. The former had a delivery time of 10 secs. when set in an aspirator as Fig. 4. This time was halved on applying only 1 lb. air pressure.

The pipette is normally constructed in resistance glass; it is thus proof against all

the usual reagents and is readily cleaned and sterilised.

The author is indebted to Mr. A. J. Targett and Mr. F. F. W. Flaig for valuable suggestions. The principle of operation is patented, and arrangements are being made for the pipettes to be made available through the usual suppliers.

Fuel and the Future

Conference Next Week

SEVERAL papers of particular interest to the chemical and allied industries will be presented at the conference on "Fuel and the Future" which is to be held under the auspices of the Ministry of Fuel and the Fuel Efficiency Committee in London next week.

Among those to be included in the Tuesday afternoon session in the library of the Central Hall, Westminster, from 2-15 p.m.-5 p.m., are: Mr. J. H. Singer, "Freeze Drying in Penicillin Manufacture"; Mr. A. S. White, "Drying of Chemical Products"; Mr. A. C. Hutt, "Factors Affecting Thermal Efficiency of Driers"; Mr. J. C. Lowson, "Electric Infra-Red Drying"; Dr. A. W. Scott, "Drying of Food and Waste Products" Mr. E. H. Farmer, and Mr. C. G. Six, "Spray and Roller Drying"; Mr. W. O. Mead-King, "Drying of China Clay." Eight papers on "Factory Heating and Air Conditioning" will be presented at the Wednesday morning session in the ballroom of the Carlton Hotel, Pall Mall, from 10 a.m.-12.45 p.m., and there will be another session at the same time in the Livingstone Hall, Livingstone House, Broadway, S.W.1, with the general subject "The Coke-Oven Industry." The papers to be given at the Wednesday afternoon session in the Royal Empire Society's building in Northumberland Avenue, W.C.2, from 3 p.m.-5.45 p.m., will be: Mr. B. E. A. Vigers, "Fuel Economy in Relation to Other Factors in the Design of Chemical Factories"; Dr. A. C. Dunningham, "Fuel Efficiency in the Chemical Industry"; Mr. W. F. Gerrad, "Inhibition of Corrosion"; Dr. A. C. Dunningham and Mr. J. H. Chalk, "Fuel Efficiency in the Plastics Industry."

The British Aluminium Co., Ltd., Salisbury House, London Wall, London, E.C 2, announced this week that the prices of raw and fabricated aluminium products have been adjusted in conformity with the recent increase in price of virgin aluminium and the further increases in production costs. In the case of raw aluminium products the new prices are in operation now; those for fabricated products become effective on October 14.

S.C.I. Plastics Group

Chairman's Forthcoming Speech

THE Plastics Group of the Society of Chemical Industry will hold its first meeting of the 1946-47 session next Tuesday, October 8, at Burlington House, Piccadilly, London, W.1, at 6.30 p.m., when Mr. N. J. L. Megson will deliver the chairman's address under the title: "Recent Advances in Plastics."

Mr. Megson will speak of the influence of the war on developments in the high polymer field, including special materials to meet exceptional Service requirements, *e.g.*, Polythene as a flexible high-frequency dielectric; ion-exchange resins for producing potable water from sea-water; P.V.C. and synthetic rubbers, etc., as substitutes for natural rubber. He will also deal with new materials such as silicones, diallyl and other doubly unsaturated resins, vinyl co-polymers, etc., and new types of plasticisers for thermoplastics used at low temperatures. Special processes, such as low-pressure moulding, post-forming of laminated stock, use of high frequency heating, welding, etc., will be surveyed and fundamental work described on the constitution of phenolic resins, kinetics of resin reactions, relation between structure and properties, and strength of laminated stock. Finally, Mr. Megson will describe certain German developments on polyurethanes, polyvinyl carbazole, "Koresine," "Luvitherm" process, acetylene chemistry, Buna, etc.

German Technical Reports

Latest Publications

SOME of the latest technical reports from the Intelligence Committees in Germany are detailed below. Copies are obtainable from H.M. Stationery Office at the prices stated.

CIOS XXX—109. *Hydrogen peroxide storage practices in three German plants* (2s.).

BIOS 495. *Copper and copper base alloy tube manufacture* (5s.).

BIOS 633. *I.G. Farben, Bitterfeld*: Manufacture of oxalic acid (1s. 6d.).

BIOS 679. *I.G. Farben, Bitterfeld*: Manufacture of potassium dichromate and chromic acid (2s. 6d.).

BIOS 680. *I.G. Farben, Wolfen*: Manufacture of caustic soda, chlorine and HCl (4s.).

FIAT 273. *Interview with Dr. J. W Reppe, I.G. Farben, A.G.*: Acetylene chemistry (2s.).

FIAT 522. *The beryllium industries of Germany and Italy* (1939 to 1945) (9s.).

FIAT 737. *Economic study of German synthetic wares* (3s.).

Wool Wax Alcohols—II*

Further Industrial Uses : Some Reaction Products

(*Continued from* THE CHEMICAL AGE, *September* 28, 1946, *P.* 375.)

IMPROVEMENT of lubricating oils and greases offers other examples of the many uses for these alcohols. One process incorporates, into lubricating oils, wool wax alcohols plus alkaline or alkaline earth soaps in proportions from 0.5 to ? per cent. Thirty parts of this mixture of alcohols and soaps (1 : 1) added to 70 parts of lubricating oil gives a good consistent grease. An emulsified solid grease, particularly suitable for the lubrication of axles and trucks, tubs, etc., is characterised by the feature that the oil from which it is prepared is first treated, to produce partial polymerisation, to electric glow discharges and is then mixed with up to 5 per cent. water, using wool wax alcohols to assist emulsifying.

A lubricating preparation for preventing corrosion of metal working parts by liquids or vapours, consists of a lubricating oil, plus both a blown oil and wool wax alcohols, with one or more heavy metal soaps, such as aluminium, calcium, cobalt, thallium, etc. Such a lubricant is capable of absorbing corrosive liquids, forming water-in-oil emulsions. Lubricants of this type can be used on sulphur dioxide pumps, acidic solution pumps, and especially rock drills as used in mines.

The general properties and chemical characteristics of wool wax alcohols indicate that on technical grounds they might find application in the paint and related industries as emulsifying, dispersing or flatting agents or as plasticisers. A preliminary survey of the potentialities of the material was therefore made under these headings.

Emulsions

In experiments to evaluate the emulsifying powers of wool wax alcohols it was not possible to make stable O/W bitumen materials using wool wax alcohols alone (up to 5 per cent.); but fixe varnish, *i.e.*, linseed oil, congo varnish base without thinner, emulsified readily with wool wax alcohols alone, to give very stable W/O emulsions. In the presence of ammonium oleate these emulsions reversed and fairly stable O/W emulsions were obtained. This emulsion on aging and also on grinding with difficult pigments was found to be much more stable than a similar material prepared from ammonium oleate alone, but not equal to an emulsion prepared with ammonium oleate and glue, as in a normal oil-bound distemper.

The dispersing powers of wool wax alcohols have been examined in linseed oil and linseed stand oil, using lithopone and lemon chrome pigments and compared with lecithin as a control. The general conclusion is that wool wax alcohols improve the dispersing properties of linseed oil to a rather lesser extent than lecithin; neither wool wax alcohols nor lecithin brings linseed oil to the level of stand oil. Addition of wool wax alcohols to stand oil does not greatly affect its already good dispersing properties. In general, wool wax alcohols perform better with lithopone than with lemon chrome.

Textile Uses

One of the chief drawbacks to the use of paraffin and hydrocarbons generally as lubricants for textiles has been the difficulty of effectively removing them, but a lubricant consisting of paraffin wax, wool wax alcohols and a solution of sodium octadecanoyl methylaminoethane sulphonate, in the form of an emulsion, is claimed to be free from such difficulties. The presence of the fatty alcohols is given as the reason for the considerably higher lubrication obtainable and, in part, for the ease of removal.

Small amounts of cholesterol, or wool wax alcohols, added to mineral wool-combing oils, will enable such oils to be washed from fibres. Oils so blended have been found to give residual oil figures not greatly different from those of olive oil when tested similarly.

Textile materials, especially those having a basis of cellulose, may be much improved by the presence of fatty alcohols, particularly wool wax alcohols. Such alcohols render the material more amenable to knitting and other mechanical operations, and dyeing and delustring operations are greatly facilitated. A given example of the manner in which these alcohols may be applied contains acetone soluble cellulose acetate in 2.5 times its weight of an acetone/water mixture (95 : 5); and to this mixture is added 10 per cent. by weight (on the cellulose) of wool wax alcohols, the charge being mixed, filtered and spun. Lubricants for cellulose acetate yarns, comprising mixtures of 45 per cent. mono-ethyl ether of diethylene glycol, 45 per cent. of diethylene glycol and 10 per cent. wool wax alcohols, are a protected article, and benefits to be derived by their use include their good solvent action on fugitive colours, and the fact that deep shades are obtainable with minimum amounts of dyestuff. Other claimed improvements deal with the knitting of yarns

* Abridged from *Wool Wax Alcohols in Industry*, by E. S. Lower, technical director of Croda Ltd., Croda House, Snaith, Goole, Yorkshire.

and also that the products yield fabrics of soft handle and freedom from scroop.

Wool wax alcohols have been found suit able for inclusion in non-adhesive thickening agents, used, for example, in combination with colouring matter in producing pastes for printing on various fibres including silk, wool, cotton, etc. These thickening agents are illustrated by the following example: 500 parts of water are stirred at 50-80° C. with 50 parts fatty alcohol and 5 parts of sodium stearylsulphonate, giving a firm stiff paste. Of this 20 to 40 per cent. may be used in the printing composition.

Some Uses of Reaction Products

The alcohol mixture obtained from wool wax has been found to be suitable starting material from which to prepare metal alcoholates, designed, in the first instance, for inclusion in paint-, lacquer-, and varnish-removing gels. The alcoholates are obtainable by known methods or, in so far as they are new compounds, produced analogously to the known higher alcohols. These alcoholates are worked up into gel-like compositions with paint-removing solvents. Different metals give different qualities of product, of course, and some have been found useful as stiffening agents for waxes or candles, for insulating purposes, etc.

Anti-rachitic materials are a great stride from paint removers, but this only serves to emphasise the many-sided nature of the products under discussion. It has been noted earlier that substances having anti-rachitic properties may be obtained by subjecting appropriate steroids (including sterols and derivatives of sterols such as esters, ethers and hydrocarbons) to the action of compositions containing sulphuric acid and acetic anhydride at relatively high temperatures. It is not essential to employ pure Liebermann-Burchard steroids such as cholesterol or ergosterol, as wool wax mixed alcohols are given in one example, patented in the U.S., as specific starting materials. In this example the alcohols were mixed with acetic acid, into which mixture sulphuric acid was gradually poured, followed by the anhydride, after which the mass was heated for three hours at 93° C., the acetic acid being removed under vacuum and the washed residue neutralised with lime, yielding a product of a potency of 425 A.O.A.C. units per gram. Similar results have been obtained by simply irradiating the alcohols, when, according to a German patent, the creation of a vitamin-*D* content is claimed.

Wool wax alcohols are mentioned as reactants in the making of condensation products from aminotriazine by reaction with compounds containing one alcoholic group and an aldehyde. Here finely ground melamine, formaldehyde, and a little hydrochloric acid are heated to solution, and wool wax alcohols are added and the whole heated once more for an hour or so, yielding glass-clear or white viscous liquids or pastes. The markets for such products are to be found in the textile, wool, paint and paper industries for use as binding agents, impregnating agents, drying oil additives, etc.

A rather different type of condensation product—the water-soluble sulphonated derivatives—is produced with the aim of overcoming many disadvantages attending the straight sulphonated alcohols. Essentially, the process for their production consists of first esterifying the alcohols with boric acid and subjecting the boric esters or borates so formed to treatment with a sulphonating medium in the presence of other boric esters or borates. In these latter, however, aliphatic alcohols contribute the alkyl radical, *e.g.*, sperm oil alcohols or oleyl alcohol are employed instead. The compounds formed, after neutralisation in the usual manner, are dissolved very easily in water, giving weakly yellow solutions; they are excellent wetting, washing, and especially softening agents for textiles, leather, etc., and for improving soaps.

It has been suggested, following the extensive investigations of Lifschutz, from 1908 onwards, and as a result of work done on the unsaponifiable matter of sewage greases, which contains a quantity of cholesterol and other wool wax alcohols, that by heating this unsaponifiable mass to about 400° C. with small quantities of caustic soda or copper sulphate, two molecules of the contained sterol components are mildly dehydrated to form an ether, a condensed product, as a result of which drying properties are imparted to the waxy matter, thus making it suitable for substitution of varnish oils, etc.

Esters and Ethers

Of the various esters synthesised from wool wax alcohols, the phosphoric acid esters are found of use in lubricants for high-pressure work. A special feature of these is that they contain substances which are able to react with the metals on the surfaces to be lubricated to form thin layers of chemical compounds which serve to improve lubrication, as they are continually swept away by friction and replaced by new layers of the order of molecular dimensions. In contradistinction to other known additives for this purpose, the phosphoric acid esters do not cause subsequent corrosion of the lubricated surfaces. The preparation of the esters requires the melted alcohols to be stirred with phosphorus pentoxide at 70° C., then left until separation into two layers takes place, when the upper one is decanted and contains free anhydride and esters, blendable with lubricating oils. The products may be formed in the oils. Wool wax acetates and formates have been used similarly.

Other phosphoric derivatives are involved

in a process for the manufacture of textile agents or leather auxiliaries by treatment of the alcohols in the presence of the soap formed in their manufacture by saponification, with phosphorus trichloride. The products are converted into glyceryl esters and sulphonated. Water-insoluble boric acid esters of wool wax alcohols are produced if the alcohols are heated with boric anhydride. These are soluble in organic solvents, however.

Other Uses

Ethers of wool wax alcohols have been prepared and used for textile cleansing, dyeing, finishing, in a sulphonated form, and in admixture with ethers of alcohols with less than six carbon atoms. Small additions of these chemicals are said to improve the washing properties of salts of the type trisodium phosphate, or water-glass.

Preparations having the constitution of ethers, again mainly intended for the textile mills, are obtained when fatty alcohols, including wool wax alcohols, are introduced over a period of an hour, into ethionic acid at 40-50° C., while stirring, which is continued until test samples are soluble in water, when the mass is converted into sodium or ammonium salts, very suitable apparently for use as soap substitutes.

Wool wax alcohols freed of agnosterol and lanosterol have been acetylated and subsequently treated with sodium glycerate or glycolate and the ether formed separated, purified, dried and sulphonated, giving derivatives of excellent cleansing power. This is stated to be a very smooth way of obtaining wool wax ethers.

Water-soluble phenolic compounds of wool wax alcohols may be obtained by heating reacting proportions with the hydrohalides of sulphonic acid salts of complex phenolic amines (obtained by condensing phenol, formaldehyde and secondary amines). Such materials are described as emulsifying, dispensing, tanning and germicidal agents.

The unsaponifiable components of wool wax have been used in processes resulting in colloidally water-soluble compounds useful as soap substitutes, by reaction (with or without the aid of solvents), with sodium metal, giving brown waxlike substances. Resins prepared from wool wax alcohols by heating with rosin, glycerine, and metallic oxides above 200° C. are said to have good solubility and to give varnishes of good film strength and flexibility.

The sulphonation of wool wax alcohols has been achieved by various methods, including, for instance, a method wherein the alcohols are mixed with 98 per cent. sulphuric acid and gradually heated to 100° C. At the same time acetic anhydride is admixed, the mixture being kept well stirred for several hours, after which time the mass is poured into ice water and the reaction products washed after addition of sodium sulphate, when they may be converted to their alkali salts. Another process converts the alcohols first to their acetates, then sulphonates these compounds with oleum or chlorosulphonic acid. Textile and leather manufacturing plants are given as the consuming industries for these products, suitable for emulsifying, moistening, and cleansing.

Sulphonation products of wool wax alcohols which are simultaneously esters and sulphonic acids are known. These are prepared by direct reaction of the alcohols with polysulphonic acids of aromatic hydrocarbons, stoichiometrically, so that finally the products still contain one unesterified sulphonic group. An illustration of this process first prepares naphthalene disulphonic acids by reactions of oleum and naphthalene, which are subsequently mixed with the fatty alcohols, keeping the temperature below 35° C. The sulphonates so formed are introduced into ice water and neutralised with soda lye. These sulphonates serve as wool washing agents and are claimed to have extraordinary stability, being completely stable to the hardest waters, inorganic and organic acids, and multivalent metal salts without precipitation. They have also been used as starch dispersing agents and matt finishing agents with pigments.

Classifying Literature

System Sought in U.S.A.

THE United States Patent Office, Department of Commerce, has invited the nation's inventors to come forward with a new system of classifying technical literature, which is now multiplying at such a rapid rate that it threatens to throttle not only the work of the Patent Office, but of scientists and inventors as well.

Existing systems of classifying human knowledge are hopelessly inadequate to meet modern needs, according to the Commissioner of Patents. The result is that an increasingly large body of technical scientific information cannot be classified so that it can be utilised to the fullest extent. Scientists and inventors are often hampered in their work by having to grope their way through the increasingly great bibliographical disorder in the various fields in which they are interested.

In the early days of the patent system, inventions were for the most part simple, few in number, and easy to classify. In 1836, when the present patent system was set up, all patents were organised under 16 general classifications. Since then nearly 2,500,000 patents have been issued and new patents are pouring in at the rate of 8000 a month as the pace of technical development throughout the industrial world moves ever faster.

Personal Notes

MR. A. RYRIE has been appointed to the board of J. & J. Colman, Ltd.

MR. J. H. ENNION has been appointed a director of Metal Industries, Ltd.

MR. C H. HUTTON-WILSON has been elected a director of Eaglescliffe Chemical Co., Ltd.

MR. L. B. ROBINSON and MR. H. V. CASSON, alternative directors of National Fertilizers, Ltd., have resigned from the board.

MR. WILLIAM STEWART is resigning his directorship of Stewart & Lloyds, Ltd., on November 30, after 49 years' service with the company.

MAJOR C. J. P. BALL, MR. T. F. A. BOARD, MR. R. S. CUMMING, and MR. C. F. MERRIAM have been appointed directors of the Distillers Co., Ltd.

MR. W. O. MEADE-KING, a director of English Clays Lovering Pochin & Co., Ltd., is flying to Tanganyika to inspect big deposits of china clay at Pugu Hills, 20 miles from Dar-es-Salaam.

In the University of St. Andrews, MR. D. M. G. LLOYD has been appointed lecturer in chemistry at United College, and MR. J. L. COPP, lecturer in chemistry at University College, Dundee.

MR. E. S. WADDINGTON, of Philips Industrial (Philips Lamps, Ltd.), who has been appointed vice-chairman of the finance committee of the Institute of Welding, has been a member of the Council of the Institute for some time. He has also been appointed to the Council of the Sheet & Strip Metal Users Association.

DR. F. HEATHCOAT, vice-principal and head of the department of chemistry and metallurgy at Swansea Technical College, has been appointed principal of the Barnsley Technical College. Dr. Heathcoat is B.Sc. of Sheffield University; after graduating he spent five years in research on organic chemistry and coal chemistry, obtaining his Ph.D. in 1930 and M.Sc. in 1938

DR. WESLEY COCKER, who has been senior lecturer in chemistry at King's College, Newcastle, for the past seven years, and was formerly a lecturer in chemistry at University College, Exeter, has been appointed to the chair of General Chemistry, which carries with it Directorship of the Department of Chemistry, at Trinity College, Dublin. He takes up the new appointment on January 1.

MR. D. P. C. NEAVE has been appointed a director of Fisons, Ltd., in place of MR. L. B. ROBINSON, resigned. Mr. Robinson, who has also resigned his position as managing director of the Imperial Smelting Corporation, Ltd., has been appointed managing director of the Zinc Corporation, Ltd., jointly with MR. W. S. ROBINSON, and managing director of New Broken Hill Consolidated, Ltd.

DR. GEORGE J. JANZ, of Winnipeg, who has been awarded an I.C.I. fellowship by the University of London, was a member of the central research laboratory of Canadian Industries, Ltd., at McMasterville, Quebec. He will continue research in the department of chemistry at the University of London, where he will remain for a term of at least three years. He is a graduate of the University of Manitoba and the University of Toronto.

DR. W. J. DONALDSON, lecturer in chemistry at the Constantine Technical College, Middlesbrough, and formerly chemistry master at the Royal High School, Edinburgh, has been appointed lecturer in chemistry at Robert Gordon's Technical College, Aberdeen. Dr. Donaldson received the degree of Ph.D. for research work on physical and colloid chemistry carried out at Edinburgh University. During the war he was seconded for special service with I.C.I.

Belgian Chemical Notes

Glass Exports Up

THE Belgian glass industry continues to work at the maximum rate allowed by restricted fuel supplies, and exports of window glass have increased considerably.

In the bottle manufacturing branch, fuel shortages are being overcome by the conversion of furnaces from coal to oil, and within recent weeks new oil-fired furnaces have been put into operation at the Verreries du Pays de Liége et Campine at Moll and the Verreries Bennert et Bivort at Jumet. A trade agreement has just been signed with Denmark, under which Belgium will deliver miscellaneous glass and glassware to the value of 18,250,000 francs in exchange for ammonium sulphate, photographic products, electrolytic copper, and metallic products.

The Allied Control Authority has allocated to Belgium the Fabrik Hess-Lichtenau chemical and explosives factory (Hesse) under the reparations agreement.

The refractory industry is being severely restricted by lack of the requisite earths, imports from France having fallen away almost to nothing. The position is so serious that only two firms were able to quote in response to a recent application for tenders by the State Railways for 39-42 per cent. qualities. On the other hand, manufacturers are complaining that British firms are now quoting for deliveries to Belgium at prices c.i.f. Antwerp considerably lower than domestic prices.

General News——

——From Week to Week

The offices of the Iron and Steel Board have now been established in Bush House, Strand, London, W.C.2. The first meeting of the Board was held in London on Tuesday.

The Council of Industrial Design has decided that the "Britain Can Make It" exhibition shall remain open in London until the end of November, so great has been the public interest.

The Film Committee of the Association of Scientific Workers has recently issued a pamphlet, *Notes on The Formation of Scientific Film Societies,* copies of which can be obtained from the head office, 15 Half Moon Street, Piccadilly, London, W.1.

Boiler-house and maintenance personnel who have profited from previous publications in the Fuel Efficiency series issued by the Ministry of Fuel will be interested in *The Installation and Maintenance of Boiler-house Instruments,* the latest addition to the series, free copies of which are obtainable from Ministry of Fuel regional offices.

Ex-Service employees of the Castner Kellner Works, I.C.I., Runcorn, were recently entertained to a tea and social evening by the Works Social Service. Mr. V. St. J. Killery, chairman of the general chemical division, said the division had a large programme of construction and rehabilitation, which would take five years to complete.

To conserve supplies of silver for industry, and to avoid the high cost of importing silver, a Bill is to be introduced early in the next parliamentary session to permit the minting of cupro-nickel coins in place of silver. Silver coins now circulating would be called in for melting as the new currency becomes available.

The new session's programme of the Textile Institute opened last week with an address on "Modified Fibres" by Professor Speakman, of Leeds. Subsequent meetings will deal with such chemical aspects of textile technology as proteins, plastics, and glass yarns and cloths; dust-control and scientific factory lighting are also among the subjects to be covered.

Addressing Glasgow Rotary Club, Mr. William Sinclair, vice-president of the Scottish Motor Trade Association and the Dunlop Rubber Co.'s regional manager for Scotland, said he had often been told that Russia made all her own war-time tyres from "substitutes like dandelion juice." Actually, her war-time tyres were made in Britain and America. He felt that not enough recognition had been given to the war-time work of the "back-room boys" in Britain and America—the rubber chemists and technicians—in producing a synthetic substitute.

By a new agreement between the Government of the U.K. and the U.S.A. announced on Tuesday, the U.S. undertakes to purchase an additional 200,000 tons of natural rubber between now and the end of the year. Stocks in this country will be drawn on to the extent that purchases cannot be made good from Malaya.

A strike involving 600 workers at the Shawfield Chemical Works of J. & J. White, Ltd., Rutherglen, has been reported from Scotland. Employees are objecting to a number of dismissals on grounds of redundancy, and to the retention of non-union workers. The company states that a reconstruction scheme in the furnace department implies the dismissal of about 80 men.

The chairman of East Pool & Agar, Ltd., the Cornish tin-mining company, has announced that the C.I.C. has refused permission for the issue of fresh capital; he is therefore of opinion that there is now little alternative but liquidation, as it will probably be a long time before the Ministry of Fuel's committee inquiring into metalliferous mining can give positive results.

Sir Stafford Cripps, President of the Board of Trade, will, in the next session of Parliament, introduce a bill to reform company law. The bill will carry into effect the changes suggested in the Cohen Committee's Report, and will cover a number of matters, including nominee shareholders, misleading company names, payment of directors, contents of prospectuses, and publication of accounts.

Kidderminster Town Council has agreed to sell for £6080 a site of 16.75 acres to Johnson, Matthey & Co., Ltd., who propose to erect a factory for the refining, smelting and rolling of special metals. Ultimately it is hoped that 250 men will be employed at what is described as a "primary producing unit." The Board of Trade will grant the necessary facilities to erect buildings on an area of 50,000 sq. ft., including offices, with provision for future extensions, and it is estimated that it will take eighteen months to two years to complete.

Foreign News

The opening date of the next Brussels International Commercial Fair has been fixed for May 12, 1947.

The Australian Government is to spend £3,000,000 in the search for oil, mainly in the Kimberley area of North West Australia.

U.S. consumption of copper during August was the biggest for any month in a year and a half. It represented an increase of 22,901 tons over the July figure of 96,743 tons.

It is hoped to increase Spitzbergen's coal output, which will amount to about 50,000 tons this year, to 300,000 tons in 1947, with a further increase to 800.000 by 1948.

Recovery in Greek industry made considerable progress in July, when output of the chemical industry reached 41 per cent. of the 1939 figure.

The board of the Attock Oil Company report that oil has been struck at a new field 12 miles from Joya Mair in the Punjab at a depth of 8200 ft. Initial results give a production of 350 barrels daily.

The production of pig iron in the British zone of Germany during August was the highest of any month since the occupation. Steel production also increased, so that the record figures achieved in July were exceeded.

Owing to the manpower position, the production capacity of Sweden's iron and steel industry cannot be fully made use of. The fuel position has recently improved, but is still not quite satisfactory.

The Norwegian Government proposes shortly to resume commercial exchanges with Germany. It will supply the Soviet zone with sulphur and fishing products in exchange for machinery and potash.

A deposit of calcite, which is reported to contain over 5,000,000 kg. of the mineral, of a remarkably high quality, has been discovered in the Brazilian state of Goiás, near the town of Matauna, only a few miles from a main road-transport route.

A new electrolytic method of extracting manganese from United States low-grade ores has been developed by the U.S. Bureau of Mines. It may in time become possible to produce manganese cheaply enough to compete with imported ores.

The second Congress of the Pan-American Institute of Mining Engineering and Geology is being held in Rio de Janeiro in the first half of October. There will be excursions to Minas Geraes, to S. Paulo and to the coalmines in Santa Catarina and Rio Grande do Sul.

Recent borings for oil in the area around Salvador, in the Brazilian state of Bahia, have given extremely encouraging results. The most promising, according to the Rio correspondent of *The Times,* is expected to yield 1500 barrels of petroleum daily, and the Government is to build a local refinery with a daily capacity of 2500 barrels.

Purchases of the French Supply Mission at Buenos Aires during the year ended June 30 included 30,090 tons of quebracho extract, 575 tons of casein, 7794 tons of industrial oils, 153 tons of tungsten, 5200 tons of wolfram, 60 tons of cellulose, 397 tons of glycerine, 18,387 tons of flax-seed, 2145 tons of industrial tallow, and 5200 tons of zinc.

An interesting outcome of the St. Erik's Fair at Stockholm has been the reappearance, after six years, of the journal *Frankrike-Sverige,* published by the French Chamber of Commerce in Sweden with a view to encouraging trade between the two countries concerned.

Production of the group of Canadian industries making chemicals and allied products had an aggregate value of $472,300,000 in 1945, according to a preliminary estimate by the Dominion Bureau of Statistics, showing a sharp decline of 35 per cent. from the total of $730,900,000 in 1944. About 983 establishments were in operation in this group in 1945, employing an average of 60,000 workers throughout the year.

The demand for products of Shawinigan Chemicals, Ltd., in Canada, has necessitated operation of the plant at a high level of capacity, but restrictions in the supplies of steel and other raw materials have, to a certain extent, curtailed production of some items. The subsidiary concern of Canadian Resins and Chemicals, Ltd., has begun production of "vinylite" plastics in a new plant.

The suggestion that the Antarctic regions contain large uranium deposits was recently put forward by Sir Douglas Mawson, head of the geological department of Adelaide University, when addressing the Australian and New Zealand Association for the Advancement of Science. He maintained that these regions resembled those districts of Northern Canada where uranium ores were found.

Allocations of crude rubber to essential consumers in Italy still leave much to be desired, but to judge from the capacity and degree of activity of the two principal manufacturing concerns, Pirelli and Michelin, production conditions are rapidly becoming normal in the rubber industry. Deliveries promised by UNRRA (15,000 tons of natural and 15,000 tons of synthetic rubber) will allow the production of more tyres than the country produced in the last pre-war years.

Forthcoming Events

October 7. Oil and Colour Chemists' Association (Hull Section). Royal Station Hotel, Hull, 6.30 p.m. Mr. G. H. Harries: "The Evaluation of Crude Petroleum Oils."

October 7. Society of Chemical Industry (Yorkshire Section). Leeds University, Woodhouse Street, Leeds, 7 p.m. Professor J. B. Speakman: "The Newer Synthetic Fibres."

October 7. Society of Chemical Industry (London Section). Chemical Society's rooms. Burlington House. Piccadilly. London, W.1, 6.30 p.m. Dr. W. H. J. Vernon:

"Chemical Research and Corrosion Control : Some Recent Contributions of a Corrosion Research Group."

October 8. Society of Chemical Industry (Plastics Group). Burlington House, Piccadilly, London, W.1, 6.30 p.m. Mr. N. J. L. Megson: "Recent Advances in Plastics."

October 8. Institution of Chemical Engineers. Geological Society's Rooms, Burlington House, Piccadilly, London, W.1, 5.30 p.m. Mr. D. G. Murdoch and Mr. M. Cuckney: "The Removal of Phenols from Gas Works Ammoniacal Liquor."

October 9. Association of British Chemical Manufacturers. Grosvenor House, Park Lane, London, W.1. Annual dinner, 7-7.30 p.m.

October 8. Hull Chemical and Engineering Society. Church Institute, Albion Street, Hull, 7.30 p.m. Mr. J. N. Blake, Mr. C. E. Rhodes, Dr. E. Downing, Mr. R. Lyth: "Notes on Analytical Technique."

October 10. Oil and Colour Chemists' Association (London Section). Royal Institution, 21 Albemarle Street, London, W.1, 6.30 p.m. Professor H. W. Melville: "The Chemistry of High Polymers—II."

October 10. Society of Chemical Industry (Plastics Group, jointly with Bristol Section). Bristol University, Woodland Road, Bristol, 5.30 p.m. Mr. N. J. L. Megson: "Recent Advances in Plastics."

October 11. Society of Chemical Industry (Chemical Engineering Group). Geological Society's Rooms, Burlington House, Piccadilly, London, W.1, 5.30 p.m. Mr. R. Scott, A.M.I.Chem.E.: "Chemical Engineering in the Tar Industry."

October 11. Society of Public Analysts (Physical Methods Group, jointly with Cardiff and district section of the Royal Institute of Chemistry and South Wales section of the Society of Chemical Industry). University College, Cathays Park, Cardiff, 6.30 p.m. Mr. A. D. E. Lauchlan: "Recent Developments in Apparatus for pH Measurement and Electro-titrations"; Mr. R. J. Carter: "Some Applications of Electrometric Methods of Analysis"; Dr. D. P. Evans: "Polarisation End Points."

October 15. British Society for International Bibliography. Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2, 2.30 p.m. Dr. B. M. Crowther: "The Use of the Universal Decimal Classification in Periodical Abstracting Services for Scientists and Engineers"; Dr. S. C. Bradford: "The Problem of Complete Documentation in Science and Technology."

October 16. Society of Chemical Industry (Agriculture Group). Physical Chemistry Lecture Theatre, Royal College of Science, South Kensington, London, 2.30 p.m. Dr. F. Gross: "An Experiment in Farming the Sea."

October 16. British Association of Chemists (Liverpool section, jointly with the Association of Scientific Workers). Stork Hotel, Queen Square, Liverpool, 6.45 p.m. Conference on "Salaries and Working Conditions in the Chemical Industry." Speakers: Dr. McMorgan, chairman, Manchester branch, A.Sc.W.; Mr. F. Crone, area organiser, A.Sc.W.; Mr. Stewart Cook, organising secretary, B.A.C.; Mr. H. H. Hutt, chairman, Liverpool section, B.A.C.

October 17. The Chemical Society. Municipal College, Southampton, 7 p.m. Dr. H. J. Emeléus: "Chemical Aspects of Work on Atomic Fission."

October 17. The Chemical Society. The University, Western Bank, Sheffield, 2.30 p.m. and 6 p.m. Professor Jaroslav Heyrovsky: "The Principles and Applications of Polarography."

October 17. Oil and Colour Chemists' Association (London Section). Royal Institution, 21 Albemarle Street, London, W.1, 6.30 p.m. Professor H. W. Melville: "The Chemistry of High Polymers—III."

October 17. The Chemical Society. Burlington House, Piccadilly, London, W.1, 7.30 p.m. Mr. R. A. Baxter, Mr. G. T. Newbold and Mr. F. S. Spring: "Pyrazine Derivatives"; Mr. L. J. Haynes, Mr. E. R. H. Jones and Mr. M. C. Whiting: "Researches on Acetylenic Compounds : Acetylenic hydroxy-acids and their Reactions."

October 18. Association of Special Libraries and Information Bureaux (Northern Branch). Hornby Library, William Brown Street, Liverpool, 3, 3 p.m. Mr. A. B. Agard Evans: "Information Service and the Export Trade."

Company News

The directors of **Imperial Chemical Industries, Ltd.,** announce that they have declared an interim ordinary dividend of 3 per cent. (actual) in respect of the year ending December 31, 1946.

The nominal capital of **Scottish Laboratories, Ltd.,** London, W, has been increased beyond the registered capital of £5000 by the addition of £5000, divided into 6 per cent. cumulative preference shares of £1 each.

Metal Traders, Ltd., report net profit of £9545 for the year ended March 31 last, as compared with £7027 for the previous year. The dividend per unit has been increased from 6d. to 9d.

James M. Brown, Ltd., manufacturers of chemical and other products, etc., London, W.C.2, have increased their nominal capital

beyond the registered capital of £100 by the addition of £49,900, divided into 998,000 ordinary 1s. shares.

Fairbank Kirby (Wholesale) Ltd., chemical manufacturers, etc., Grimsby, has increased its nominal capital beyond the registered capital of £1000 by the addition of £5000, divided into 5 per cent. cumulative redeemable preference shares of £1 each.

Although the net profit of **Murex, Ltd.**, for the year ended June 30 last was substantially less than for the previous year—£201,489, as against £213,082—a final dividend of 10 per cent., plus a cash bonus of 2½ per cent., has been declared for the tenth successive year, thus bringing the total payment for the year up to 20 per cent.

Details have been issued of Treasury-sanctioned capital issue by **Petrocarbon, Ltd.**, to provide finance for its subsidiary, Petrochemicals, Ltd. (see p. 405). The share capital of Petrocarbon, Ltd., is £82,500, of which £75,000 is £1 6 per cent. preferred ordinary shares and the balance in ordinary 1s. shares. This has been provided. Loan capital consists of 4 per cent. registered notes totalling £1,800,000, one-half of which is in " A " notes and the other " B " notes. The whole of the " A " notes, ranking before the " B," will be subscribed at par by the Finance Corporation for Industry, while the " B " notes are being placed privately.

New Companies Registered

Ferro Metal & Chemical Corporation, Ltd. (420,049).—Private company. Capital £10,000 in £1 shares. Dealers in metal ores, chemicals, and plastics, etc. Director: J. L. Holt. Registered office: 2/5 Old Bond Street, W.1.

Kent Laboratories, Ltd. (419,446).—Private company. Capital £100 in £1 shares. Manufacturing and general chemists, etc. Directors: D. Glass: Mrs. V. E. A. Wilmin; Miss J. Penn. Registered office: 2-5 Old Bond Street, W.1.

Secto Company, Ltd. (418,845).—Private company. Capital £1000 in £1 shares. Manufacturers of and dealers in insecticides, distinfectants, chemicals, acids and fertilisers, etc. Directors: E. Woolley, W. E. Woolley. Registered office: Phoenix Mill. King Street, Blackburn.

Stronghold Industries, Ltd. (418,857).—Private company. Capital £5000 in £1 shares. Manufacturers and dealers in plastic substances, synthetic resins, chemicals, fertiliers, etc. Directors: E. B. Thompson: D. W. R. Andrew. Registered office: 104 High Street, Winsford, Ches.

United London Overseas Trading Corporation, Ltd. (419,586).—Private company. Capital £500 in £1 shares. Manufacturers of and dealers in chemicals, waxes, steel, iron, rubber, plastics, etc. Director: A. Brimson. Registered office: 38 Warwick Avenue, W.9.

Technopol Plastics, Ltd. (419,391).—Private company. Capital £10,000 in £1 shares. Manufacturers of and dealers in hard and soft plastics, etc. Subscribers: W. C. Summer; Leo. Edgard. Registered office: 120 Pall Mall, S.W.1.

Union Chemical Co., Ltd. (419,486).—Private company. Capital £1,000 in £1 shares. To carry on business as indicated by the title. Directors: P. Manovill: I. Spitzer; F. J. Shopland. Registered office: 10/11 Fetter Lane, E.C.4.

Lamberts (Langley Mill), Ltd. (419,049).—Private company. Capital £2000 in £1 shares. Manufacturing research chemists, etc. Directors: J. C. O. Hallam; E. Pilkington. Registered office: Valley Works, Langley Mill, near Nottingham.

Plastic and Chemical Products (Surbiton). Ltd. (419,207).—Private company. Capital £2000 in £1 shares. To carry on business as indicated by the title. Subscribers: E. R. Baker; W. T. Frere. Registered office: Elm Road, Hook, Surbiton, Surrey.

W. J. E. Gould, Ltd. (419,083).—Private company. Capital £3000 in £1 shares. Wholesale and retail chemists, etc. Directors: F. Holden: E. Muldowney; J. Whitehouse. Registered office: 1 Broad Street, Teddington, Middlesex.

Wax Products, Ltd. (419,491)—Private company. Capital £1,000 in £1 shares. Chemists, druggists, dyers, manufacturers of and dealers in natural and synthetic waxes, etc. Directors: D. C. Westbury; L. G. Parsons. Registered office: 158-168, Kensal Road, London, W.10.

Slinter Mining Company, Ltd. (418,850).—Private company. Capital £1000 in £1 shares. To search for, raise and work barytes, fluorspar, lead, copper, coal, iron and other minerals, lime, limestone, etc. Directors: P. Gregory; P. W. Gregory. Registered office: Braeside, Cromford, nr. Matlock.

Chemical and Allied Stocks and Shares

STOCK markets, although firmer, were subdued in the absence of buying interest. British Funds remained little changed, but industrial shares, after earlier declines, were inclined to improve, and good features were not lacking, although movements generally were small and indefinite, Wall

Street and international uncertainties still being the dominating factors. Home railway stocks were better among the nationalisation groups, while there was further buying of colliery shares on break-up value estimates.

Chemical and kindred shares have been firm generally, partly owing to the news of big expansion schemes indicating confidence in the industry's future. Imperial Chemical were steady at 41s. 10½d. xd. The unchanged interim dividend was in accordance with expectations, but it had the effect of drawing attention to the fact that the yield offered compares favourably with the yields on many other leading industrial shares, and there are general expectations in the market that the total dividend for the year will be kept at the 8 per cent. which has ruled for a lengthy period. Fisons were 58s. 9d., B. Laporte 98s. 9d., Greeff-Chemicals Holdings 5s. ordinary changed hands around 12s. and Monsanto Chemicals 5¼ per cent. preference were 25s. Considerable interest attached to Morgan Crucible issue of "A" ordinary £1 shares at 51s., which offered the public their first opportunity of acquiring an interest in the equity or ordinary shares of this well-known company.

Levers, following their recent rally, have come back to 52s. 3d. Turner & Newall were 82s., United Molasses 50s., Imperial Smelting 18s. 9d. and Amalgamated Metal 18s. 9d. The 4s. ordinary units of British Glues & Chemicals showed firmness at 16s., while in other directions, Low Temperature Carbonisation 2s. shares have further strengthened to 3s. 6d. on the progress statement. Among collieries, Bolsover moved higher at 61s. 6d., Powell Duffryn were 24s. 4½d., Sheepbridge 46s. 6d., Shipley 41s., and Horden Collieries 26s. 4½d. Iron and steels showed small indefinite movements, although Stewarts & Lloyds rallied to 50s. 9d. and Guest Keen to 41s. 9d., but United Steel eased to 25s. 3d. Thos. Firth & John Brown shares at 46s. 3d. xd. regained part of the decline, which followed the reduced interim dividend. Elsewhere, Dunlop Rubber were firmer at 70s. 3d., as were the units of the Distillers Co. at 130s. 6d. Goodlass Wall 10s. ordinary, after easing, rallied to 28s. 6d. and on hopes of a higher interim dividend, Pinchin Johnson strengthened to 44s. Textiles recorded small declines, Bleachers being 12s. 9d. and Bradford Dyers 23s., but Calico Printers rallied to 23s. 4½d. Courtaulds were 52s. 3d. and British Celanese 32s. 3d.

General Refractories have been steady at 19s., and British Match 46s. 6d. British Oxygen at 95s. regained part of an earlier decline. British Aluminium were 41s. 6d., but elsewhere, Nairn & Greenwich at 82s. 6d. and Barry & Staines at 52s. 6d. lost ground, although, as in many other instances, the lower prices were due mainly to the small buying interest in markets; selling generally has been on a limited scale, but with inactive conditions prevailing, it tended to have a disproportionate influence.

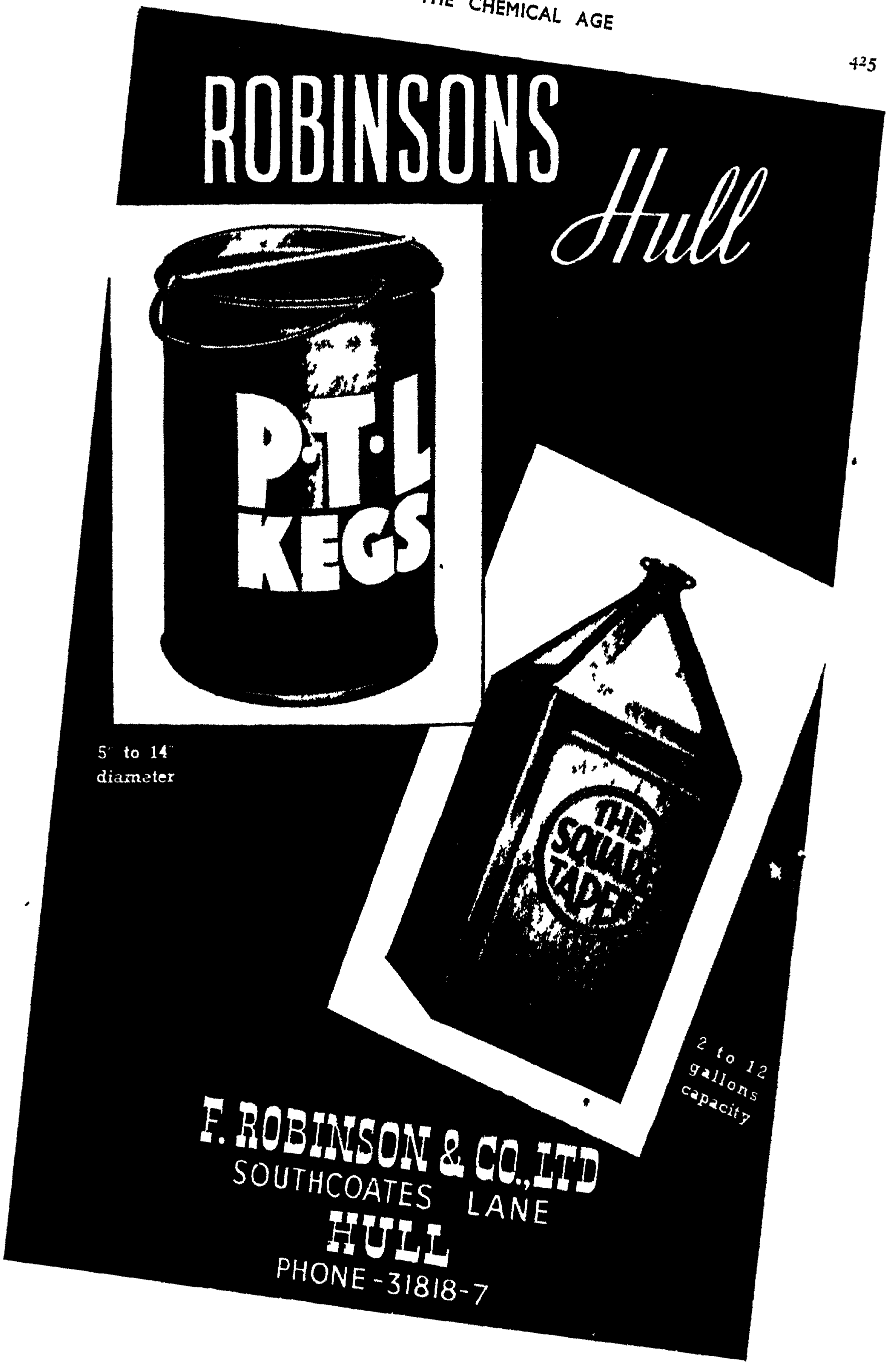
Boots Drug at 58s. 3d. rallied moderately after losing ground. Beechams deferred were 24s. 6d., Griffiths Hughes 59s., and Sangers 33s. Triplex Glass were a weak feature, these 10s. units falling from 40s. 3d. to 32s. 6d. following the halving of the dividend from 15 per cent. to 7½ per cent., but later recovered to 35s. before again receding, to 33s. Although at the last meeting the chairman pointed out the difficulties likely to be experienced owing to transition factors, the market had taken the hopeful view that it might be possible to maintain the dividend. Oil shares lost ground, Shell easing to 89s. 4½d. and Burmah Oil to 66s. 3d., while Attock Oil fell 3s. on the reduced dividend.

British Chemical Prices

Market Reports

MOST sections of the London general chemicals market report reasonably satisfactory trading conditions with no important change in the price position. Deliveries against contracts are proceeding along steady lines and a fair amount of new business has been in evidence. In the soda products section there is a good call for bicarbonate of soda, nitrate of soda and soda ash, while supplies of chlorate of soda and bichromate of soda are inadequate to meet present requirements in full. Hyposulphite of soda is firm and in steady request. There has been a steady pressure for supplies of yellow prussiate of potash and both carbonate of potash and permanganate of potash are receiving a steady inquiry. In other directions the lead oxides are in active demand and formaldehyde, arsenic and hydrogen peroxide are moving steadily. There has been little change in the coal-tar products market, supplies generally being well absorbed for some time ahead.

MANCHESTER.—Steady trading conditions have been reported on the Manchester chemical market during the past week. Deliveries under contract to the textile and other using trades in the district have been called for steadily, especially the full range of the alkali products, while a steady outlet for the potash, magnesia and ammonia compounds has also been reported. The mineral acids are meeting with a good demand. Inquiry from shippers during the week has been of fair extent and some additional business on export account has been reported. In the tar products section most lines are being called for in good quantities and a moderate weight of actual new buying has been a feature.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Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Carboxylic acids.—B. F. Goodrich. 26122.

Fatty acids.—L. Haskelberg. 25823.

Sulphonamide derivatives.—R. M. Hughes. (J. R. Geigy A.G.) 26351.

Dyestuffs.—E. R. H. Jones, K. J. Reed, and I.C.I., Ltd. 26128.

Conversion of organic substances.—Laboratoire de Recherches Industrielles. 25881.

Treatment of alloys.—Magnesium Elektron, Ltd., E. F. Emley, and A. C. Jessup. 25993-4.

Hydrocarbons.—Phillips Petroleum Co. 25782.

Fertilisers.—J. W. R. Rayner, J. H. Hudson, and I.C.I., Ltd. 25749.

Treatment of cellulosic material.—J. C. Seailles. 25874-5.

Calcium aluminates.—J. C. Séailles. 25876-7.

Phosphoruc products.—J. C. Séailles. 25878.

Recovering alumina.—J. C. Séailles. 25660.

Calcium aluminates.—J. C. Séailles. 26046-7.

Alumina.—J. C. Séailles, and Soc. des Ciments Français. 26052.

Synthetic hide.—J. Seraphim. 25771.

Plastic material.—J. Seraphim. 25772.

Artificial leather.—J. Seraphim. 25773.

Alumina.—Soc. des Ciments Français. 25661.

Alumina.—Soc. des Ciments Français. 25879, 26053.

Purification of penicillin.—H. Steiner, E. Zimkin, and Petrocarbon, Ltd. 25649.

Alloy steels.—C. Sykes, and Earl of Halsbury. 26030.

Utilising atomic energy.—A. Vaugean, and J. Le Michel. 26173.

Complete Specifications Open to Public Inspection

Separation and concentration of diolefins.—Standard Oil Development Co. July 22, 1942. 8709/43.

Preparation of 5-amino-acridines from diphenylamine-2-carboxylic acids.—Sterling Drug Inc. March 3, 1945. 5439/46.

Production of powders having a base of phenols, substituted or not, and products obtained thereby.—G. Truffaut, and I. Pastac. June 9, 1943. 23625/46.

Unsaturated polymeric materials.—United States Rubber Co. March 1, 1945. 898/46.

Treating bauxite and particularly silica and iron containing bauxite.—I. de Vecchis, and O. Ramuz. March 2, 45. 6458/46.

Production of antibiotic substances.—Winthrop Chemical Co., Inc. March 3, 1945. 5440/46.

Heat exchangers for heating viscous liquids.—Babcock & Wilcox, Ltd. Dec. 19, 1939. 24418/46.

Resinous compositions.—Bakelite Corporation. March 7, 1945. 7026/46.

Adhesive bonding of surfaces or in relation to adhesive compositions suitable for use therein. March 9, 1945. 6960/46.

Gas separation process.—Carbide & Carbon Chemicals Corporation. March 6, 1945. 4751/46

Protective layers obtained upon aluminium or its alloys.—Compagnie de Produits Chimiques et Electro-Metallurgiques Alais, Froges et Camargue. Nov. 9, 1943. 28063/45.

Manufacture of polymers.—E.I. Du Pont de Nemours & Co. March 6, 1945. 7008/46.

Synthetic linear polyamides.—E.I. Du Pont de Nemours & Co. March 6, 1945. 7009/46.

Manufacture of polymers.—E.I. Du Pont de Nemours & Co. March 6, 1945. 7010/46.

Synthetic linear polymers.—E.I. Du Pont de Nemours & Co. March 6, 1945. 7011/46.

Preparation of para-tertiary amino aromatic aldehydes.—E.I. Du Pont de Nemours & Co. March 9, 1945. 7263/46.

Manufacture of cyanhydrins.—E.I. Du Pont de Nemours & Co. March 9, 1945. 7278/46.

Soft solders for aluminium and its alloys.—H. Grunauer. March 9, 1945. 7485/46.

Process of providing magnesium and its alloys with a protective surface coating against corrosion.—K. G. Haag, and A. U. Trägardh. Dec. 15, 1943. 24289/46.

Anodic polishing methods for metals and alloys.—R. E. Halut. March 5, 1945. (Cognate application 6827/46.) 6826/46.

Interpolymers of ethylene and organic vinyl esters.—I.C.I., Ltd. June 6, 1942. 9091/43.

Polymerisation and copolymerisation of acrylonitrile.—I.C.I., Ltd. Aug. 2, 1943. 14729/44.

Production of vitamin preparations.—Jiri Schicht Akcova Spolenost. Oct. 20, 1941. 23681/46.

Cellulose derivatives. Mo och Domsjö Aktiebolag. March 9, 1945. 7337/46.

Water-resistant characteristics of resins and resinous articles and resinous products resulting therefrom.—Norton Grinding Wheel Co., Ltd. Sept. 28, 1942. 15768/43.

Method of producing ammonia from hydrogen and nitrogen.—Odelhog, S.-O. March 8, 1945. 8389/46.

Preparation of phenthiazone derivatives.—Soc. des Usines Chimiques Rhône-Poulenc. March 5, 1945. (Cognate application 5083/46.) 5082/46.

Apparatus for rectifying in continuous operation under vacuum raw phenols and other mixtures of homologous compounds.—Soc. pour l'Exploitation des Procédés Ab-der-Halden. April 24, 1942. 28172/45.

Organo-silicon compounds.—Westinghouse Electric International Co. March 9, 1945. 7307-10/46.

Hydrocarbon material.—P. J. Wilson. March 10, 1945. 9628/46.

Complete Specifications Accepted

Production of styrene and its homologues by dehydrogenation.—Distillers Co., Ltd., H. M. Stanley, F. E. Salt, and T. Weir. Feb. 15, 1943. 580,088.

Process for the plasticisation of rubber.—Dunlop Rubber Co., Ltd., D. F. Twiss, and F. A. Jones. June 24, 1943. 580,247.

Water-resistance of shaped articles comprising polyvinyl alcohol.—E.I. Du Pont de Nemours & Co. June 18, 1943. 580,206.

Coating compositions.—E.I. Du Pont de Nemours & Co. March 20, 1943. 580,258.

Thermosetting plastic compositions comprising polyvinyl acetal and ketal resins.—E.I. Du Pont de Nemours & Co. June 5, 1943. 580,275.

Production of synthetic resin compositions of improved physical and chemical properties.—W. E. F. Gates, and I.C.I., Ltd. Dec. 22. 1943. 580,250.

Resinous condensation product and method of making same.—General Tire & Rubber Co. Feb. 17, 1943. 580,184.

Preparation of β β' β''-trichlor-α α' bis 4-chlorphenylethane or *pp'*-dichlordiphenyltrichlorethane.—G. W. Gladden, and W. W. Cocker. June 21, 1944. 580,224.

Process for the production of chromic hydroxide.—W. Glaser. Dec. 6, 1943. 580,181.

Sulphur-containing compounds or composions and methods of making the same.—H. W. K. Jennings. (Wilmington Chemical Corporation.) June 15, 1944. 580,189.

Process for the preparation of α-nitro-isobutene.—A. E. W. Smith, C. W. Scaife, and I.C.I., Ltd. March 13, 1944. 580,256.

Manufacture of organic nitro compounds.—A. E. W. Smith, C. W. Scaife, H. Baldock, and I.C.I., Ltd. April 3, 1944. 580,260.

Manufacture of monoazo-dyestuffs.—Soc. of Chemical Industry in Basle. Oct. 12, 1942. 580,092.

Process for producing fast dyeings on cellulose fibres.—Soc. of Chemical Industry in Basle. March 18, 1942. 580,174.

Manufacture of dyestuffs.—Soc. of Chemical Industry in Basle. April 2, 1942. 580,175.

Process for the catalytic conversion of hydrocarbon oils.—Standard Oil Development Co. Jan. 31, 1942. 580,087.

Manufacture of modified synthetic resins.—W. Walker & Sons, Ltd., J. R. Alexander, D. Burton, and F. Hausmann. April 12, 1943. 580,120.

Production of fluorinated organic compounds.—W. B. Whalley, and I.C.I., Ltd. May 26, 1944. 580,140.

Manufacture of polyazo dyestuffs.—Williams (Hounslow), Ltd., and H. Ackroyd. March 31, 1944. 580,122.

Anti-coagulant bis (4-hydroxy) coumarine and process for making the same.—Wisconsin Alumni Research Foundation. Oct. 11, 1941. 580,084.

Manufacture of aldehydes.—British Celanese, Ltd. June 12, 1943. 580,383.

Saponification for cellulose ester materials.—British Celanese, Ltd. July 15, 1943. 580,433

Synthetic resinous condensation products British Thomson-Houston Co., Ltd. March 26, 1942. 580,405.

Manufacture of *N*-acylthiomethyl carbonamides.—E.I. Du Pont de Nemours & Co. March 1, 1944. 580,357.

Manufacture of solid and semi-solid polymers from aliphatic mono-olefines.—E.I. Du Pont de Nemours & Co. Dec. 3, 1942. 580,416.

Manufacture of copper mercaptides.—E.I. Du Pont de Nemours & Co., and A. L. Fox. Nov. 8, 1943. 580,366.

The Chemical Age

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VOL. LV No. 1424. October 12, 1946 Annual Subscription 21s. Overseas 26s.

Damnosa Hereditas

FOR ten years we, the British people, have warred against the aggressors of Europe. From 1914 to 1918 we suffered in the mud of France and in the heat or cold of many climes. We and our allies triumphed; and our heritage was to sink with the world into a Slough of Despond such as needed a Bunyan to describe. The records of the strikes and labour unrest of the world in general and of this country in particular are written in the books of history, but in our hearts they are still vivid experiences. The world was lost in a mist of doubt, as it were, from which it failed to extricate itself in time. The uneasy peace in due season came to an end, and the world began again to prepare for war. In the preparations for war came temporary economic salvation. Workshops were busy again, mankind basked in the sunshine of pros-prosperity—a spurious prosperity, perhaps, but proving something that we had known all along. It proved that what ailed the world was insufficiency of work. Put people to work, pay them adequate wages so that they might buy some at least of the things they need, and happiness and contentment would return. Of course, we knew that all along, as we have said; the trouble was that no one knew how to bring it about. The war of 1914-1918 left us with a ruinous heritage indeed: "*damnosa hereditas*" as old Gaius called it nearly 2000 years ago. The tower of Babel again played its fateful part in human history, and mankind, unable to speak the same economic language, failed to solve its troubles, even though the end to be achieved could be seen clearly.

Once again we have taken up arms against the same aggressor as in 1914-18. This has been a fiercer struggle, because not only the fighting men have been involved but also because the whole nation has been in the firing line with no quarter given or asked. The shouting and the tumult are dying away. The bench of international judges has laid bare, after the most historic trial the world has yet known since Pontius Pilate, the whole sorry story of intrigue, cruelty, and lust for power. It may serve as a warning for the future, or it may not. Trials are held every day, criminals are convicted, sentences are passed—but crimes continue to be committed. What concerns us now, however, is the future. We cannot go back; we dare not stop to look back; mankind must go forward.

But the *damnosa hereditas* remains with us. Once more war has brought devastation and ruin. There is ruin in Germany, and in many enemy

On Other Pages

countries. We may say that that serves them right, but the nations of the world are like the pillars of a building. The fall of one or two of them may well bring the whole edifice down, as Samson showed long before Gaius wrote. The structure is inevitably weakened. Therefore, while taking steps to preserve peace, we must also now take steps to restore prosperity.

The ruinous heritage of war rests heavily upon this nation too. Let us look at the situation not from the political angle, but, so far as lies in our power, with the dispassionate view of the historian. It is always difficult to obtain the right historical perspective when events are happening around us, and to us. The predominant characteristic of our time is Socialisation. The earlier years of the industrial revolution in this country left much to be desired in the impact of their events on the mass of our people. The feelings engendered then have perhaps stayed in our subconscious minds so that to many people the events in Russia after the 1914-1918 war did not seem to be so much a *damnosa hereditas* as something to be welcomed and emulated here. We remained sane, fortunately, but this last war has indeed left us a ruinous heritage indeed. It has brought the great majority of our countrymen to declare in favour of socialisation of our way of life. Whether any particular industry is nationalised or not hardly matters from the historian's angle. He will see the events of the present time as part of a major movement in social history. It is accepted by our rulers that no one should be rich, but that every one should have sufficient. Their anxiety lest anyone should get an ounce more than another of the good things of this world has caused them to discourage the sending of private parcels of food from people abroad to those in this country—to such lengths has socialism gone! That is not a serious point of history; it is nothing more than one of the straws which betoken the direction of the wind.

The Times has recently written in a leading article about "the distinctive character of contemporary British policy and British achievement," which, it says, "constitute the claims to leadership in the world's councils." The article goes on to say: "In the General Election last year, which marked a definite stage, this distinctive attitude was given a distinctive form and emphasis; *the centre of gravity was set markedly nearer to a planned economy and farther from laissez-faire.*" The nationalisation issue is part of that "planned economy" of which the article speaks. It demands that a certain proportion of industry, probably an increasing proportion, shall be brought under the control of the State. Which industries are selected depends not in the least on whether they are individually well-run, as Government spokesmen would have us believe; it depends entirely on which ones will fit best into a planned economy.

The particular uncomfortable legacy which this latest war has left with us is that of control. Private enterprise is frowned upon. Initiative is stifled by the State in order that Socialism shall be established, so that we shall "go farther from *laissez-faire.*" We are told what clothes we must wear; we are told how much food we may eat. Those who have lately journeyed abroad testify on their return to lands across the seas which, compared with Britain, flow with milk and honey: but we must have none of it lest the planned socialist State be placed in jeopardy. We are told that we may go to an exhibition and see things that are made in this country; but we must not touch them. They are for the foreigner, not for the inhabitants of a socialist State. Russia, and her five-year plan, is the prototype that our rulers now follow. Not for nothing did Sir Stafford Cripps spend part of the war as our ambassador to that country.

The result is disastrous. Faced with no incentive to work; with no prospect of amassing the wealth that is the spur to incentive; with nothing on which to spend any money earned, this nation is falling far behind in the international field. Our people do not work as they worked before the war and during the war, when there was something to work for. Our coal output goes down; strikes are prevalent; a spirit of discontent pervades the atmosphere. It is rarely that one meets a truly contented man, even less rarely a contented woman. Some of our personal friends have lately spent a considerable period in the United States. They have returned in despair at the difference between the two peoples. There they report an alert, confident, vital nation, full of the joy of living, and with something worth living to live for. Here, in contrast, they report despondency and a feeling of hopelessness, a country from which initiative and incentive have departed. It is true

that a few of our technical men retain their skill and energy; we speak not of the few, however, but of the many. What is the remedy—for remedy there must be if we are to survive.

The remedy, surely, is to give people something to work for. Socialism has not had a very long run yet, but it is already quite clear that whatever form it is given must not be such as to conflict with human nature. Unless a nation is to become a nation of slaves, there must be the incentive to progress, there must be freedom to progress in whatever way appears best to the individual. It may be that America has gone too far in that direction. Already there is alarm in that country because there are not enough goods to buy with the wages that men earn. Americans are being urged to greater productivity. That must seem astonishing to Britons who have for so long been accustomed to regard America as the land of high outputs. But Americans have recognised the fact that if there is the means to purchase without the goods to purchase, there will be inflation. The British Government understands that too, we believe, but their solution is the reverse of that of the U.S.A. The British Government withholds the goods, thus removing the incentive to hard work, and *also* takes away whatever spare money we may secure, thus subtracting also the incentive to enterprise.

NOTES AND COMMENTS

A New Textile—Some Day

THERE appears to be no end to the initiative and ingenuity displayed by British research workers in the field of industrial science. On another page of this issue is recorded the development of yet another synthetic fibre, founded on terephthalic acid and ethylene glycol, and known, so far, by the name "Terylene." In this case the research was carried out during the war by workers of the Calico Printers' Association, and the development of the product has been entrusted to I.C.I. So far, so good. But now comes the rub, the ubiquitous obstacle against which so many high enterprises in Britain find themselves beating their wings to-day. It is as yet only on the laboratory scale that "Terylene" has been examined; and the report issued by those concerned with it says, somewhat bitterly, that even if its early promise is fulfilled, it must be years rather than months before the fibre can be available in appreciable quantities for the textile industry. And why? Simply because of "the delays that occur in the development of all projects at the present time, arising out of difficulties of supply of equipment and buildings."

No Spur to Action

THIS complaint, we know, is only too well justified; on every side we find evidence of the "drab disheartenment and frustration" which Mr. Churchill spoke of only last week. How mystified the Germans must be when they read that a country which, with half its man-power away, could yet produce aircraft enough to beat off the prepared assault of the Luftwaffe; which could in a few months achieve the completion of the Mulberry harbour so as to make possible the invasion of Europe, can now no longer raise the energy to develop a new and valuable industrial discovery! The clue, of course, is the complete absence of incentive. Then, in 1940 and 1944, our lives and liberties were at stake; but what is there to be gained now? Presumably the right to pay a larger proportion of Income Tax, or the duty to apply for more and better licences. It is not enough. To better ourselves, we are told, is immoral: it savours of the "profit motive." Unhappily, however, it becomes daily clearer that socialist theory has completely failed to find an alternative spur to action.

Conference on World Tin

THE International Tin Conference which began its deliberations on Tuesday was called into being by the Britsh Government after consultation with the Governments of the United States, the Netherlands, Belgium, and Bolivia. It was convened, in the words of Mr. John Wilmot, Minister of Supply, who opened the conference, so that "all the main interested countries, both producers and consumers, should together consider the prospective world tin position and consider whether continuous inter-government study of that position is required." Although tin is an expensive metal it has unique qualities which make it an essential metal for industrial use. It

is non-toxic and is therefore indispensable to the food industry which uses half the world's supply in food containers. Its low melting point, low thermal conductivity and extreme ductility ensure a big demand for the metal in solder and bearings of all kinds. Any shortage of tin, therefore, has repercussions on many industries.

Present Tin Shortage

THE six principal Eastern tin areas from which most of the pre-war supply of tin was obtained—Malaya, Dutch East Indies, Siam, China, Burma, and Indo-China—will this year export about 20,000 tons compared with 160,000 tons in 1941. Although there is a reserve of 90,000 tons of tin, most of it in the United States, this is only sufficient for a six months' supply at the 1939 rate of consumption. Many of the Far Eastern mines are in areas which were overrun by the Japanese who had no large tin demands, so the mines became derelict and the machinery was either left to rust or removed elsewhere. These mines now have to be rehabilitated. Old equipment has to be repaired, or new machinery provided. In Malaya where labour was dispersed by the Japanese, a new force will have to be recruited. And in some other areas political complications must be cleared up before mining is renewed. Several years may elapse before large supplies of tin again become available. But although there is a present shortage of tin, the British Government is looking forward to the time when supply outstrips demand. And with the tin regulation scheme, which has been in force for the past 15 years, terminating at the end of this year, the International Tin Conference was convened so that it could decide whether continuous inter-government study of the tin position is advisable. If it does think so then a wider organisation than the present two international bodies—the International Tin Committee and the Combined Tin Committee—charged with the task of keeping the tin position under constant review may be called for.

A Precarious Profession

A CORRESPONDENT in an Australian mining journal bemoans the shortage of good prospectors and refers with nostalgia to the bygone days when prospectors, unlike their present-day successors, " could tell gold when they saw it." This set us thinking about the qualities and education, if any, which a prospector needs to be successful in his frankly precarious profession —a profession for which, apparently, a university education is not a *sine qua non*. First and foremost stand good health, good eyesight and an ability to withstand hardship. Given this physical make-up, what are the qualifications to be acquired before setting out on the trail? An essential is knowledge—and not merely a superficial knowledge—of the minerals sought, and an understanding of the kind of rock in which they usually occur and the conditions in which they form. One who from the very nature of his work is well seasoned for prospecting work is the miner. But he usually lacks the essential broad knowledge of minerals and geology. Nevertheless, mining is the best preliminary education for prospecting if the miner has an agile mind free from prejudice and is not always ready to jump to conclusions.

Knowledge of Low-Grade Ores

AS the present-day prospector is unlikely to strike a " bonanza," he must have sufficient knowledge to decide whether the low-grade ores which are his usual finds will justify the expenditure of labour and time in their exploitation. He must have an inquiring and open mind so that the obvious, and perhaps wrong, conclusion is not instantly accepted. And he must possess a faculty of observation so trained that anything unusual, a slight change in the colour of the rock or the occurence of unique vegetation, is sufficient to make him stop and investigate. Apart from use of his technical knowledge, the prospector will also have to exercise much ingenuity in other directions. In the field he will have to do his own cooking as well as his own blacksmithing. In order to live he must know how to hunt, stalk and fish. Above all, to obtain the best results from his labours, he must persevere. Obviously, many of the qualifications needed cannot be obtained simply by attendance at a college. They can only be acquired gradually by young men in the field, working alongside experienced prospectors.

A three-year plan for the expansion of the Netherlands nitrogen industry has recently been submitted to the Government. It is expected to increase output from the present figure of 168 tons daily to about 300 tons.

The Catarole Process

Aromatic Hydrocarbons Produced from Petroleum

IN last week's issue of THE CHEMICAL AGE (p. 405) an account was published of the formation of a new British company to operate a process, called the Catarole process, for the production of aromatic hydrocarbons from petroleum. The paragraphs which follow contain some details of the inception of the process, together with information on the working of the process and on the nature of the resultant products.

During the past ten years it has become more and more evident that coal is no longer the only or even the main source of aromatic chemicals, and that it is possible to transform aliphatic hydrocarbons into aromatics of the same carbon number with the aid of catalysts such as alumina and promoters such as chromium oxide.* For various reasons, however, only few individual aromatic hydrocarbons have become available by working that process on a technical scale.

Coal, on the other hand, makes available the whole range of aromatics at once, but the extent to which coal tar can be produced obviously depends on the extent to which the coke, the main product of the process, can be commercially utilised.

Whole Range from Petroleum

Further research into the conversion of aliphatic hydrocarbons into aromatics has shown that it is possible to treat any non-aromatic charging stock in such a manner that the whole range of aromatic hydrocarbons is obtained. Petroleum is, therefore, no longer second to coal as a source of aromatic hydrocarbons. Also, the choice of special charging stocks or fractions and of the processing conditions makes it possible to vary the quantitative composition of the resulting aromatised product. If petroleum is passed through a packed tube at atmospheric pressure at 630-680° C. and a velocity of 0.05 0.5 litres per hour and litre catalyst volume, the resultant liquid has an aromaticity of at least 95 per cent. In addition, valuable gaseous products are formed. The use of metals (such as copper), as packing materials, reduces the temperature required for substantial aromatisation to 630-680° C., also the extent to which carbon formation takes place. These two factors, combined with the purity of the products, make the process economic.

The Catarole process can best be described as a high-temperature catalytic cracking process designed primarily to produce chemicals. Any petroleum distillate boiling below 300° C., that is, naphtha, kerosene, or gas oil, can be used as charging stock, but non-petroleum charging stocks such as oils from the low-temperature carbonisation process of coal or crude coal-tar benzols of low specific gravity have also been used with advantage.

Transformation of Charge

In the course of the process the charge is transformed into: (i) A liquid product consisting of up to 95 per cent. aromatic hydrocarbons and containing the whole range of aromatic hydrocarbons from benzene up to chrysene, pyrene, etc. and (ii) a mixture of gases rich in olefines, and again containing the whole range of petroleum gases from butenes and butanes to methane. Sulphur compounds which are present in the charge are largely eliminated as hydrogen sulphide. The losses in the process are very small, they are of the order of 0.5-1 per cent. and consist mainly of carbon which in the course of the reaction is deposited on the catalyst.

A pilot plant working this process has been in operation for five years. This plant has a capacity of 0.8 tons of charge per 24 hours. It consists of a vaporisation coil, and a number of reactors filled with catalyst, all of which are contained in gas-heated furnaces. The cracking gas itself is used to feed the burners. A quenching and condensation arrangement is provided, also gas-liquid separators and liquid storage tanks, and finally gas scrubbers. The operating pressure is slightly above atmospheric and the operating temperature is of the order of 600-700° C. The catalyst is cheap, of a robust nature and has a long lifetime. Runs are generally carried out for about 50-70 hours, and after that time the carbon deposits accumulating on it have to be burnt off. This is done in the conventional manner by recirculating flue gases with simultaneous injection of a controlled amount of fresh air. The regeneration process takes about 10 hours. An operating cycle, therefore, consists of 50-70 hours on stream and 10 hours regeneration. The pilot plant has been used to process a considerable number of widely different charging stocks to check yields, obtained previously in the laboratory, and to obtain various thermal and other design and operating data.

The proportion of gaseous to liquid products can be varied to a considerable degree by selection of appropriate charging stocks. In general the more paraffinic a charging

* See, *e.g.*: Moldavsky and Kamusher, *Chem. Zentr.*, 1936, *II*, 2339, 6713; Moldavsky, Besprosvannaya, Kamusher and Kobilskaya, *Chem. Zentr.*, 1938, 11, 1023; Grosse, Morrell and Mattox, *Oil and Gas J.*, November 24, 1939; U. S. PP., 2,124,536; 2,124,537; 2,124, 183-6; Taylor & Turkevitch, *Trans. Faraday Soc.*, 1939, 35, 921.

stock the greater the proportion of gaseous products, and the more naphthenic or aromatic a charging stock the greater the proportion of liquid products. This is reflected by the experimental result that, for fractions of different chemical composition but of the same boiling range, there is a rough proportionality between the density of the charging stock and the yield of liquid products.

Another way of increasing the proportion of liquid products is to use higher boiling charging stocks. Generally, the rule holds that the higher boiling the charging stock, the greater the proportion of liquid products. These general considerations are borne out by typical analysis given in Table 1 opposite, of the cracking products from (a) a naphthenic naphtha of East Texas origin, (b) a paraffinic naphtha of Iranian origin, and (c) a paraffinic kerosene of Iranian origin.

As far as the gases are concerned, it will be seen that the proportion of olefinic hydrocarbons is considerably higher than in any normal cracking gas and that the Catarole gas is particularly rich in ethylene and propylene. A complete process for separation of these gases by low-temperature refrigeration and subsequent fractionisation has been worked out and the corresponding plant is now being built together with the large-scale cracking plant. The butylene fraction is stated to contain 60 per cent. *n*-butylenes, 30 per cent. *iso*butylene, and 10 per cent. butadiene.

Liquid Products

These can be divided into light products boiling below 200°C., and heavy products boiling above 200°C. Of the light products there is:

(a) A small head fraction containing cyclopentadiene, isoprene, and various pentenes and isopentenes. By hydrogenation of this fraction, there is obtained an excellent aviation fuel additive of the isopentane type (octane number 84 as compared with 89 for isopentane).

(b) *Benzene Fraction.* From this there is obtained by refractionation, preferably, but not necessarily, by azeotropic distillation with methanol, a benzene fulfilling all the requirements of the British and similar nitration benzene specifications. Refining losses are very small.

(c) *Toluene Fraction.* In a similar manner from the toluene fraction by straight fractionation by azeotropic distillation with methanol, there is obtained a nitration toluene fulfilling all specification requirements. Refining losses are again very small.

(d) *Xylene Fraction.* This fraction contains, on an average, 16.2 per cent. *o*-xylene, 19.3 per cent. *m*-xylene, 24.7 per cent. *p*-xylene, 10.8 per cent. ethylbenzene, and about 20 per cent. styrene. By further fractionation, this styrene can be concentrated up to 50-60%, and from this concentrated solution a polystyrene of satisfactory molecular weight and mechanical properties can be obtained by polymerisation. Alternatively, this styrene concentrate is a very useful material for copolymerisation processes with other monomers. After removing the styrene by polymerisation, there remains a residue from which a 2°, 3°, or 5° xylol fraction which passes all required specification tests can be obtained.

Table 1

Boiling Range (Engler)	(a)	(b)	(c)
5%-95%	95-205°C.	113-183°C.	175-261°C.
Density 20°C.	0.799	0.756	0.796
[Yields in % by wt. calc. on total products (processing losses approx. 1%)]			
Gaseous Products.			
Hydrogen	0.5	0.9	0.5
Methane	18.3	24.0	13.7
Ethylene	7.4	11.6	11.6
Ethane	6.5	9.6	7.4
Propylene	9.0	10.6	10.9
Propane	1.9	1.3	1.4
Butylene	4.8	4.5	3.9
Butane	1.3	0.8	0.5
Total gases	50	63	50
Liquid Products			
Below benzene	1.1	0.4	1.0
Benzene fraction	11.0	6.1	7.5
Toluene fraction	11.0	6.5	7.5
Xylene fraction	6.0	5.1	5.8
Alkylbenzene fraction	2.6	4.5	9.4
Naphthalene fraction	3.5	2.5	3.7
Alkylnaphthalene fraction	4.0	1.7	3.8
Anthracene fraction	2.7	2.6	2.3
Chrysene fraction	2.4	2.6	1.6
Pitch residue	6.0	4.0	7.5
Total liquid products	50	37	50
	(a)	(b)	(c)
Refined naphthalene	2.3	1.2	1.7
Anthracene	0.2	0.1	0.15
Phenanthrene (80%)	0.5	0.3	0.4
Chrysene	0.3	0.2	0.2
Pyrene	0.2	0.1	0.15

(e) *Alkylbenzene Fraction.* This fraction contains about 50 per cent. of polymerisable bodies consisting mainly of indene and isopropenyl benzene. A process has been worked out to obtain from this material by polymerisation a hard and light-fast

resin which, according to tests carried out by a number of manufacturers, is an excellent material for incorporation into varnishes. After removal of the polymerisable bodies the remainder of this fraction constitutes a valuable aromatic solvent.

(f) *Naphthalene Fraction.* From this fraction naphthalene crystallises and is separated on centrifuges. After a slight washing treatment this naphthalene is sufficiently pure for the production of phthalic anhydride. By treatment with a very small amount of aluminium chloride (B.P. 571,398) a very pure naphthalene for sulphonation can be obtained from the centrifuged product.

It appears appropriate to comment on the composition of the polycyclic fraction of the reaction product, as the process to which this report refers has succeeded for the first time in converting petroleum into the whole range of such substances. They are of interest to the manufacturers of dyestuffs, pharmaceuticals, and other organic chemicals.

Alkylnapththalenes

In this fraction occur not only α- and β-methylnaphthalene and various dimethylnaphthalenes (of which the 1.2, 1.6, 1.7, and 2.6 have been identified), but also 1.2.5- and 1.2.6-trimethylnaphthalene, diphenyl, acenaphthene, and fluorene, all of which can be isolated by further fractionisation. The yields of these various bodies calculated on the alkylnaphthalene cut are as follows:

α-Methylnaphthalene	16.4
β-Methylnaphthalene	24.5
Diphenyl	4.1
Dimethylnaphthalenes	30.4
Acenaphthene	3.6
Trimethylnaphthalenes	18.0
Fluorene	3.2

%, by weight of methylnaphthalene cut.

From the crude anthracene cut a mixture containing all the anthracene and a great part of the phenanthrene crystallises. By refractionation of the mother liquors a further quantity of phenanthrene is obtained. From the crystalline part of the fraction very pure anthracene of melting point from 210° C. upwards is obtained by two crystallisations from toluene. In the toluene mother liquors there remains phenanthrene and some oil from which, after purification, phenanthrene of 80 per cent. purity is recovered.

From the chrysene-pyrene fraction chrysene crystallises spontaneously, and after one or two recrystallisations, is obtained pure. After refractionation of the remainder of the cut crystalline pyrene is obtained in nearly pure quality.

The residue from the distillation of the liquid fraction is a valuable starting material for the production of electrode coke. A high quality electrode coke must contain a minimum only of inorganic impurities. Since the Catarole pitch is subjected to at least two distillation treatments, it is clear that this requirement is likely to be fulfilled. This has been verified in a number of analyses (inorganic content of coke from pitch 0.01-0.015%).

It is interesting to note that the only side-chain appearing in these substances is the methyl group. This is undoubtedly due to the fact that longer side-chains are broken off (in form of the corresponding olefines) at the process temperature. In the "alkylbenzenes" fractions, too, polymethylated benzenes predominate. They are, however, accompanied by substances in which the unsaturated nature of the side-chain increases the stability of the molecule (resonance stabilisation), such as styrene, β-methylstyrene, and indene. The relatively high percentage of styrene, ethylbenzene, and pyrene is likewise interesting; it is believed that this fact will shed some light on the reaction mechanism.

The gaseous products, as will have been seen, are highly unsaturated. All syntheses starting from these olefines (glycol and glycol derivatives, isopropyl alcohol, acetone, etc.) thus become possible. The industrial success of the whole process depends to a large extent on the proper utilisation of the olefinic gases.

The practical importance of the process lies mainly in the fact that it produces simultaneously a wide range of those aromatic and aliphatic hydrocarbons which form the basis of the modern production of organic chemicals, and that it produces them in a state of high purity. Thus, the process may well be able to supplement the coal-tar industry which is, and is likely to remain, the mainstay of British chemical industry.

Fat Shortage

More Retained by Producers

RESTRICTED production may prevent the output of the world's fats and oils from reaching the 1935-1939 level for three years or more, reports the U.S. Department of Agriculture. During 1946 import requirements have been double the supply available for export. Although higher yields of Manchurian soya bean and Sumatran palm-oil could normally have been looked for in the near future, political unrest in these areas may prevent increased production. Other producing areas, such as India, may themselves consume much larger proportions of their output. An additional depressing factor is the international agreement to limit Antarctic whale oil production to about half the 1938 level. On the other hand, because of reduced purchasing power, some importing countries may not be able to buy so much as they did before the war.

Streptomycin in Britain

Boots Planning Large-Scale Production

BRIEF reference was made in The Chemical Age (*see* p. 400) to the press conference on streptomycin which was held on October 1 by Boots Pure Drug Co., Ltd., at the London headquarters of the company in Stamford Street, S.E.1. The company is the first British firm to install plant for the large-scale production of this drug. Moreover, it plans to replace the present method of surface culture in milk bottles by deep culture in tanks, and has provisionally allocated £67,000 for the proposed plant.

Sir Jack Drummond, D.Sc., F.R.S., director in charge of the company's scientific research, said the discovery of streptomycin was a natural outcome of the discovery of penicillin and was made in America, where conditions for going ahead with it were far more favourable than in this country. Now ten U.S.A. firms were concerned in its production and they were all bound up with the American Streptomycin Clinical Trials Committee. He thought some similar organisation in this country would ultimately be set up to control its distribution here, and to ensure that the development of streptomycin, which would take several years, was in the right hands. The greatest interest in streptomycin at the moment attached to its effect on tuberculosis. Laboratory tests on animals had shown striking results in this direction and highly encouraging, although not uniformly satisfactory, results had been obtained from small-scale trials in human beings in the U.S.A. The key to the whole problem was whether streptomycin had merely a repressive effect on tuberculosis, or whether it would bring about a complete cure. Besides tuberculosis, there were several other diseases, such as typhoid, meningitis, etc., which, it was hoped, could be cured by the use of streptomycin, and arrangements were being made for discovering its effect on leprosy.

Advantages Over Penicillin

Streptomycin, Sir Jack went on, was a white powder, with nothing striking in its appearance, but it differed from penicillin in one or two important respects. One of the most disturbing problems in connection with penicillin was that there were at least four different types, each with a somewhat different action, and until they were certain of the potency of the different types in their treatment of different diseases, and it was produced in a state of purity, they would not have a complete picture of the penicillin story. Moreover, penicillin was rather an unstable product. He did not think they need worry about a multiplicity of types of streptomycin; there was only one, and it was much more stable than penicillin. The chemical structure of streptomycin was pretty well resolved, but it looked like presenting the organic chemist with one of the most heartbreaking problems he had known, because of the difficulty of synthesising it. Another drawback was that at present it had to be given by injection, and the dose, in the case of tuberculosis, was a large one. Besides human diseases, there was a vast field in veterinary science to be considered. There would inevitably be considerable delay before large-scale production was possible. Even in the U.S.A. present production was at the rate of only about 35 kg. a month.

Elaborate Process

The process of manufacture of streptomycin was an elaborate one, similar to that used in producing penicillin. In the surface-culture methods, spores of *Actinomyces griseus* were sprayed on the surface of a medium containing sugar and meat extract, or corn-steep liquor, which was filled into milk bottles from a conveyor belt. After two or three days, white spots appeared on the surface, and these later fused together into a thin white mycelial felt. Streptomycin was excreted in measurable quantities after the seventh day. After 14 days, the mould was discarded and the liquor made acid; then it was pumped through charcoal filters, which absorbed impurities. After further stages of purification and freeze-drying, a white powder emerged. This was packed into sterile ampoules by rubber-masked and gloved workers, working with their hands under glass to prevent contamination.

The cost of producing sufficient streptomycin for the three-months course of treatment at present considered necessary for a tuberculosis patient, said Sir Jack, worked out at about £3000, employing the surface-culture method; this figure was based on American costs. Boots Pure Drug Co. was planning to replace surface culture in bottles by deep culture in tanks, and £67,000 had provisionally been allocated for the proposed plant. By that process, the cost might be reduced to one-quarter of the present figure. Subsequently, mass production was likely to to bring the cost down steeply, as had been the case with insulin and penicillin.

Answering questions, Sir Jack said reasonable quantities of streptomycin would be available within six weeks, and production at first would be at the rate of about 2 kg. a month. In the first U.S.A. tests, there

Fig. 1 (below) shows Boots' pilot plant for small-scale deep tank culture of streptomycin. The nutrient medium is being inoculated with streptomycin spores.

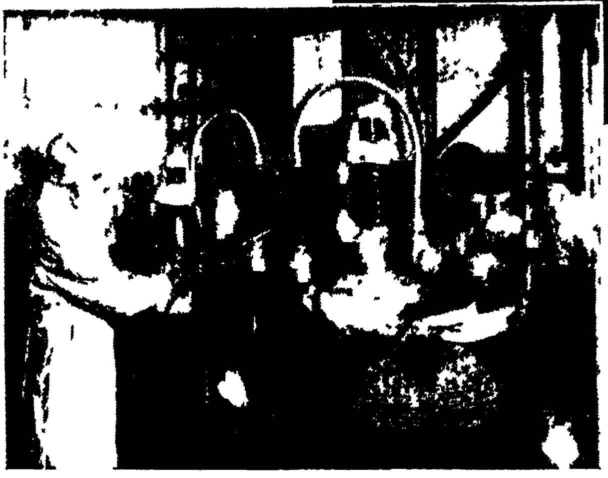

Fig. 2 (above). Final extraction stage. Bottles containing the streptomycin-loaded liquid in its penultimate state are spun at 1000 r.p.m. in a temperature of minus 50°C. preparatory to "freeze-drying."

was some evidence of toxic effects when large quantities were used, but he thought he could safely say there would be none in this country in the sort of doses given in clinical medicine.

Dr. J. B. M. Coppock, B.Sc., Ph.D., F.R.I.C., head of the company's technical development and fine chemicals division, said streptomycin might well take its place alongside penicillin.

Plastic Paper Sheet

New British Standard

In view of the increasing demand for laminated plastic materials for building and interior decorating great interest will be aroused by the issue of B.S. No. 1323, Thermosetting, Synthetic-resin, Bonded-paper Sheet for use in the Building Industry. This specification covers sheet made with phenolic-type resins, with urea or other aminoplastic type resins, or with both, supplied for use as wall-board or for veneering on to wood or other surfaces in thicknesses from 1/32 in. to ½ in. The sheet may be ordered as "finished panels," ready to be fixed without further cutting; or as "sheets for fabrication," intended for cutting or trimming by the purchaser.

The specification lays down nominal dimensions and tolerances, together with requirements for appearance, flatness, and straightness of edges and squareness of rectangular, finished panels. It also specifies cross-breaking strength and resistance to impact, to water absorption, to marking by hot water, alcoholic liquids or hot fats, to dry heat or damp heat and to the spread of flame. Requirements for satisfactory machining qualities and for certificates by manufacturers are also given, together with full methods of test and additional information upon such properties as density, thermal conductivity, lack of action on metals, and dimensional stability and upon recommended types of finishes which will be of the greatest interest to users. This publication may be obtained from the British Standards Institution, 28 Victoria Street, S.W.1 (price 2s.).

Digest of Statistics

Chemical and Allied Production and Consumption Figures

FURTHER decreases in the production and consumption of certain chemicals and fertilisers in the U.K. during July are recorded in the recently-published September issue of the *Digest of Statistics* (H.M.S.O., 2s. 6d. net). The figures given represent thousand tons.

Sulphuric acid production, *i.e.*, as 70 per cent. acid and including acid made at Government factories, was 156.6, which is 4.7 less than the June figure and 7.7 less than that for May. The consumption of sulphur for the manufacturer of sulphuric acid was 16.6, as compared with 17.0 for June and 17.9 for May. There was, however, an increase in sulphuric acid consumption, the July figure of 159.0 being 7.0 above that for June, although 17.0 below the record figure for May. Stocks of sulphur for the manufacture of sulphuric acid, which dropped in June to 58.1, after being 69.3 in May, again dropped in July, the figure being 56.7, while sulphuric acid stocks went down to 89.6 after being 92.7 in June and 81.4 in May.

Fertilisers

Superphosphate production, which reached the record figure of 95.4 in May and went down to 75.1 in June, dropped in July to 73.3. On the other hand, the consumption of superphosphate, which includes deliveries to consumers and the amounts used in compounds, rose to 76.1 after being 64.8 in June and 111.9 in May. There was an all-round improvement in the position of compound fertilisers. Production rose from 80.9 in June to 91.7 in July, and consumption jumped from the low figure of 18.9 to 53.4.

Consumption of pyrites remained almost unchanged, the July figure of 17.5 comparing with the previous month's figure of 17.6. Stocks, however, are shown as having been reduced from 88.0 to 85.0. Spent oxide consumption was unaltered at 15.6, but stocks showed a slight increase—139.6 as compared with 139.0.

The consumption of phosphate rock for fertilisers showed an improvement, the July figure of 54.9 being 4.5 better than that for June.

Ammonia consumption, including exports and deliveries to consumers in the U.K., but excluding ammonia produced in by-product factories and converted directly into ammonia sulphate, was 24.29, as compared with 25.51 for June. Stocks rose from 3.11 in June to 3.44 in July.

August production of iron ore went up slightly, the figure of 224.0 being 2.0 better than the July figure, although 2.0 below that for June. Pig-iron production again dropped, this time to 145.0, after being 147.0 in July and 152.0 in June. The August production of steel ingots and castings was the same as that in July—226.0—this figure including 11.0 alloy.

Among non-ferrous metals, the total disposals of virgin copper in July were given as 26.1, as compared with 23.7 in June and 30.2 in May. Stocks in July totalled 83.3, which is 2.4 better than the June figure. Virgin zinc disposals were 17.8—an improvement of 0.7 over the June figure—and stocks dropped from 78.2 in June to 70.4 in July. Consumption of zinc concentrates in July is given as 14.0, which is 2.9 less than in June, and stocks went down from 125.0 in June to 111.0 in July. Total disposals of refined lead in July were 17.8, which is 1.4 above the June figure. Stocks are given as 23.0, as compared with 33.7 for the previous month. Tin metal disposals in July were 17.8, which is 1.34 above the June figure, and stocks dropped to 20.0 after being 22.4 in July.

After showing an increase for the first time in seven months, the number of people employed in chemical and allied works (in thousands) dropped from 227.8 in June to 226.7 in July (including 78.4 females).

Norsk Hydro's Future

State Control Suggested

NEGOTIATIONS have been opened between the French and Norwegian Governments concerning the ownership of the majority holding in the "heavy water" Norsk Hydro concern. Before the war, French shareholders held 75,000 shares in the concern, but these were purchased in 1941 by Germans. A French court has pronounced this transaction invalid, and the French Government has now applied to the Norwegian Custodian of Enemy Property, who at present holds the shares, for their return to the former French shareholders.

The Norwegian Minister of Commerce, Mr. Lars Evenser, however, has declared that the Norwegian Government cannot accept the ruling of a foreign court, and that a settlement of the matter must await the decision of a Norwegian tribunal. He affirmed that a key industry of such importance should not be controlled by any foreign power, and that the company should be placed under state control.

The share capital of the Norsk Hydro at present amounts to 156,400,000 kroner and that of subsidiaries to over 100,000,000 kroner; all shares save those under dispute are held by the Government.

Synthetic Resins

Their Use in Varnish and Allied Industries

by A. E. WILLIAMS, F.C.S.

THE introduction of synthetic resins to the varnish and allied industries has resulted in considerable improvement in the quality of varnish, finishes, printing inks, etc., and in some cases has widened the sphere of usefulness of these products.

For example, with the aid of suitable synthetic resins it is now possible to prepare coatings which have a very high resistance to chemical action, while other types of coating may be prepared to give good fire resistance. Such features often result in considerable economy, for a varnish with good chemical resistance may be used to coat equipment and plant which is of itself vulnerable to chemical action, and so is much cheaper than chemically-resistant plant. In a similar manner the use of fire resistant coatings results in a reduction in the insurance premium, since the fire hazard is lowered, and often enables timber to be used where the more expensive metal would normally be required. The special properties of synthetic resins have made it possible to produce varnishes and finishes which have a durability and stability far surpassing that of products made solely from natural raw materials. It is interesting, therefore, to consider briefly typical examples of these British-made resins and the methods of using them to obtain optimum results.

Chemically-Resistant Resins

Resins with a high resistance to chemical action are usually employed by varnish manufacturers when preparing products to withstand not only chemical action, but also weathering, moisture, etc., to give a product which dries rapidly and possesses flexibility and toughness. A typical example of a well-established chemically-resistant resin is Bakelite R-254, which appears to have been the first concentrated phenolic resin of the oil-soluble type to be offered to the paint and varnish industry. Since this product contains no rosin, ester gum, oils, etc., it differs from the phenolic type of material previously available. Its physical properties are as follows: Sp. gr. 1.19 to 1.22 (Westphal balance method); m.p. 195° to 225°F. (modification of A.S.T.M. ball and ring method); colour, IL-2 (Hellige Comparator standard on solution of 50 per cent. resin, 50 per cent. toluol); acid number, 85 to 105 (resin dissolved in 75 per cent. benzol, 25 per cent. alcohol and titrated with tenth-normal alcoholic sodium hydroxide, using phenolphthalein indicator).

A product which has high resistance to weathering must of necessity possess high resistance not only to oxidation but to the effects of prolonged exposure to sun and rain, without losing its flexibility and mechanical strength. Experience has shown that when this resin is used exclusively as the resin content of the varnish, under normal conditions the useful life of the film is inversely proportional to the oil length, the shorter oil varnishes giving the longer life. In practice, factors other than durability have to be considered, and generally oil lengths of 2½ : 1 or 2 : 1 are chosen. This resin has high resistance to water and with a 2½ : 1 chinawood oil varnish there is no appreciable swelling of the film on immersion in water for 24 hours, while the same film shows no sign of whitening on exposure to boiling water for eight hours. If linseed oil be substituted for chinawood oil, however, there may be a slight decrease in water resistance.

Metal Protection

Where priming coats for metal protection are involved, the use of a chemical inhibitor —such as zinc chromate—is often desirable, since chemical action is invariably the cause of corrosion. In general, long oil varnish does not withstand the action of alkali as well as short oil products, *e.g.*, a 4 : 1 film resists a 5 per cent. solution of caustic soda about twice as long as a 6 : 1 film; and a 2 : 1 twice as long as a 4 : 1 film, while a 1 : 1 varnish film normally withstands the above strength of caustic for several weeks.

Vehicles incorporating R-254 resin may be used with zinc oxide, or other basic pigment, without thickening or livering occurring, provided the vehicle is properly cooked, as a varnish containing oil-gel as a result of overcooking will generally give trouble with basic pigments in all circumstances. The addition of a small proportion of this resin will usually impart to vehicles rapid drying properties without an excessive use of metallic driers, and in many cases varnishes can be produced which may be recoated within a few hours. Short oil varnishes have been successfully used in some alkyd finishes to enhance water resistance and to give more complete polymerisation throughout the film. This resin has found wide employment in coatings for yachts and aeroplanes, particularly where the finish is exposed to salt water. It is also used in protective coatings for industrial machine parts, in a wide variety of situations where resistance to chemicals and oils is involved,

and in a large variety of coatings for less onerous service.

In order to show the effects of R-254 resin on chinawood oil on heating at various temperatures and in different proportions, Bakelite, Ltd., have prepared a set of curves (Fig. 1) to assist in chosing a correct cooking procedure for any specific oil-resin mix. Thest curves show a modification of the Browne gelation test in minutes (A.S.T.M. D12-25T) at various temperatures for straight chinawood oil, and for a 75 per cent. chinawood oil/25 per cent. linseed oil mix, as well as for various oil-R-254 proportions. Such data may be used where variations in procedure are desired. The values represent time required for final solidification, and experience has shown that not more than one-fourth of this time is all that is desirable to produce a satisfactory varnish with these resins. The varnishes are so quickly gas-proofed that 15 mins. at 450° F. is ample to make a safe varnish of any oil length up to 4 : 1.

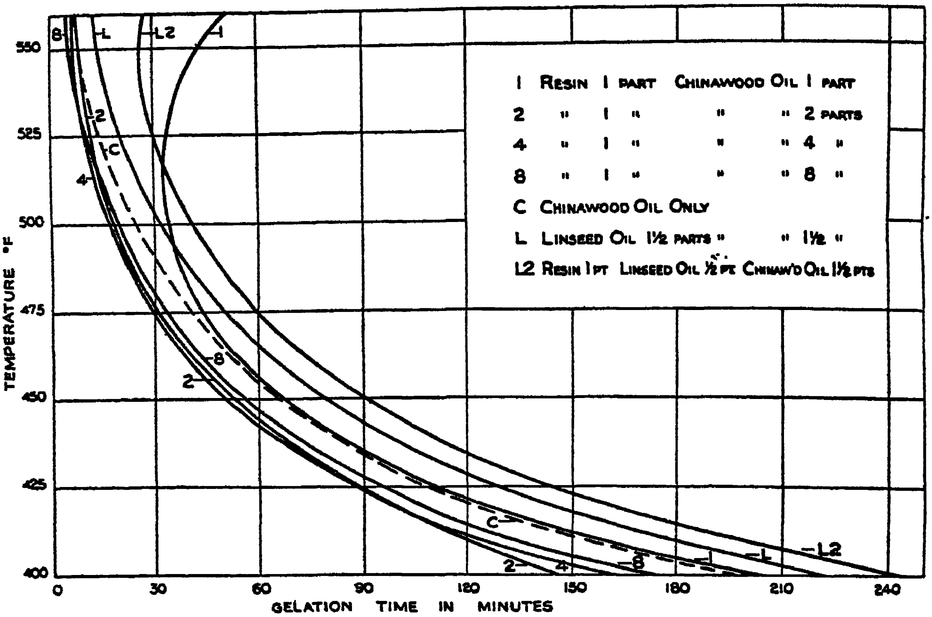

Fig. 1.

In general, it has been found that better chemical and weather resistance are produced if the resin is heated with an equal weight of chinawood oil before the main body of the chinawood oil is added. If linseed oil is used, it is preferable that it be included in this preliminary cook. The lines marked L and L2 in Fig. 1 show the gelation time of chinawood 75 per cent. linseed 25 per cent. oil mixture with R-254 resin in the proportion of a 2 : 1 oil length varnish. The value of the linseed oil addition in retarding gelation in the varnish is quite pronounced. In using such graphs it should be borne in mind that the Browne test is based upon practically instantaneous arrival at the designated temperature. Where a gradual approach to the temperature is produced, as in the varnish kettle, the rate of gelation is approximately doubled for every 25° F. increase. Integration of the time-rate values shows that for an increase of 10° F. per min. the time taken in reaching any given temperature (say 560° F.) is equivalent to very nearly five times at that temperature, so that five minutes should be deducted from the total gelation time shown to give the remaining allowable time (if the temperature rise is at the rate of 10° per min.). It is apparent, therefore, that the high temperatures often used in varnish cooking are not suitable for use with these resins in straight chinawood oil. The addition of linseed oil, however, has a retarding effect, which has been successfully utilised for carrying cooks to 560° F. for immediate checking with raw chinawood oil. Such procedure permits of only narrow latitude in the cooking schedule, but it is desirable for certain applications, such as marine coatings, which are subject to great aud rapid temperature changes. In general, best results may be obtained by using a maximum cooking temperature of 400° to 450° F.

Another resin much used for chemically-resistant finishes is Bakelite R-10825, which

is a pale 100 per cent. phenolic product. Unlike the Bakelite R-254 resin—which has a tendency to produce a yellow colour when in varnish films on exposure—films from varnishes made up with R-10825 do not show any appreciable after-yellowing, but at the same time the latter have a high resistance to chemical action, water and weathering. The principal applications of this resin are: reaction with ester gums, etc., to produce a hard resin; preparation of durable long or short oil air-drying varnishes and stoving enamels where good colour retention is necessary; making of acid- and alkali-resisting air-drying finishes; and marine varnishes and enamels. This resin is entirely soluble in drying oils, being both heat- and oil-reactive, and it greatly increases the drying speed of chinawood oil. While it does not increase the drying rate of linseed oil appreciably, it reacts with this oil to give a higher gloss. Its physical properties are as follows: Sp. gr., 1.09; acid value, 60 to 75 mg. KOH/gm.; m.p., 80 to 95 C.; colour, not darker than 3 Gardner Holdt (1 : 1 solution in toluol).

Although the m.p. of this resin is between 80° and 95° C., when it is heated alone or with ester gum the m.p. is rapidly increased. When heated in the presence of oils, thermo-hardening occurs, and the reaction is characterised by visible foaming at about 118° C. At 210° to 225° C. further foaming occurs, the rate at which this further condensation takes place depending on temperature and reaction time. In combinations of this resin with natural resins and ester gums, the heat reactivity of R-10825 is of special value, the m.p., viscosity, and resistance value of ester gums being enhanced by such treatment. For example, if 100 parts of ester gum are heated to 200° C. (in approximately 10 mins.) and 20 parts of R-10825 added (taking 5 to 10 mins. for the addition), and the tempera-

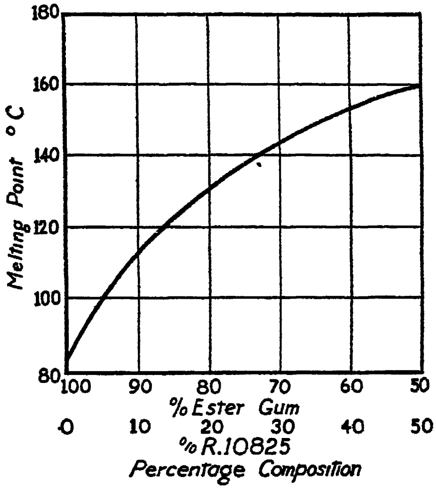

Fig. 2. Melting point of Bakelite R.10825 with ester.

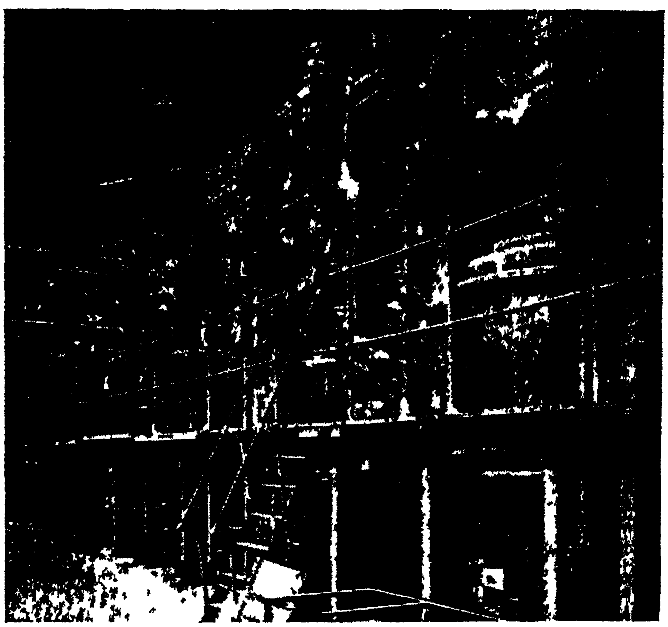

Fig. 3. Batteries of resin stills at the Bakelite factory.

ture raised to 250° C. within a further 10 mins. and held for 20 mins., the m.p. of the final resin combination will be increased to approximately 125° C., which may be seen from an examination of the graph (Fig. 2). A typical example of a varnish cook is the following:

R-10825	100 parts by weight
Chinawood oil	250 ,, ,, ,,
Linseed stand oil	100 ,, ,, ,,
Turpentine	75 ,, ,, ,,
White Spirit	225 ,, ,, ,,
Soligen lead cobalt drier	2 ,, ,, ,,

The chinawood oil is heated to 200° C, the resin slowly added and dissolved at 175° C. in about 10 mins. The temperature is raised to 265° C. in 25 mins. At about 200°-210° C. some foaming takes place. Linseed stand oil is added, the temperature is raised to 235° C. and the mix is bodied at this temperature to a 5-in. string, which takes about 5 mins. It is then cooled, thinned, and the driers are added in solution. The varnish dries hard and is gas proof.

Fig. 3 depicts a section of the synthetic resin bays in the Tyseley factory of Bakelite, Ltd., showing the batteries of resin stills in which the above resins are produced; a finished piece of Bakelite resin is shown in Fig. 4.

Products for Damp Surfaces.

Synthetic preparations which dry well under adverse atmospheric conditions of low temperature and high humidity represent another valuable addition to the range of modern finishes. Examples of these are the "Epok" products, R.996/40 and R.997/30, produced by British Resin Products, Ltd. These two materials are oil-modified phenolic resins, supplied as solutions in solvent naphtha. They have sp. gr. ranging between 0.905 and 0.920; viscosities, at 25° C., between 3 and 10 poises; and a solids content of approximately 40 per cent. These products are very highly polymerised resin solutions and dry principally by evaporation of solvent from the film. There is little tendency for the dried film to oxidise, but some further polymerisation on ageing is probable, as the film shows progressive improvement in its resistance to softening by hydrocarbon solvents. When diluted with solvent naphtha or xylol to normal brushing consistency, films of both resins dry in 10 to 15 mins. and are hard dry in 30 to 35 mins. Because of its greater oil length, R.997/40 produces films which are slightly softer and more flexible than those obtainable with R.996/40. The addition of cobalt, lead or manganese driers is unnecessary, for their only effect is to promote premature ageing.

Although both these resins are oil-modified, they will not tolerate additions of raw or heat-bodied drying oils. They have limited compatibility with blown oils, but even small additions of these oils greatly retard the drying of films of the resins and, therefore, are not recommended. Both these products can be used to toughen and plasticise other resins which are soluble in xylol or solvent naphtha; and despite their highly polymerised nature, they show no tendency to react with basic pigments, such as zinc oxide or white lead, or to gell when pigmented with carbon black. They dry well under adverse atmospheric conditions and are well suited for use in finishes which may have to be applied to surfaces which are damp or subject to heavy water-vapour condensation.

The good adhesion to metals of these films, and their stability towards the common corrosion inhibiting pigments, make them useful components of anti-corrosion primers. Because of their low solids content and subdued gloss, media based on these resins are better suited for the production of matt and semi-gloss finishes than for high-gloss paints. In general, flat wall paints and undercoats require much less pigment on R.996/40 or R.997/40, with consequent saving in both raw material and labour cost to the manufacturer. They apply easily, flow well, do not "shear" on joining up, and dry quickly to a hard flexible finish. The same type of paint used in industrial finishing can be dried by stoving for 10 to 15 mins. at 120° to 150° F. Their "build" when applied to highly absorbent surfaces is an asset in the formulation of sealer primers for asbestos sheeting and plaster board. In this field, too, speed of drying is an important advantage.

Insulating Varnish

In recent years resins and polymers have been prepared from cashew nut shell liquid (C.N.S.L.), a product of India and other countries, and this liquid probably represents up to the present time the chief economic source of a naturally occurring phenol. Cashew nut shell liquid, according to U.S.P. 2,306,077, may be chlorinated to a resinous or rubber-like product. In the presence of alkali it may be treated with an inorganic hydrocarbon ester to give mixed ether-esters, which latter, on being subjected to destructive distillation, may yield residues condensable with aldehydes.

U.S.P. 2,317,611 deals with the condensation of C.N.S.L. with phenols to yield biologically active intermediates which can be treated with aldehydes to form oil-soluble resins. In the condensation of C.N.S.L. with formaldehyde, new types of catalyst have been proposed, and new methods evolved for the polymerisation of the liquid to liquid polymers capable of further polymerisation, with or without

aldehyde, in the preparation of a product suitable for electrical insulation.

In this country C.N.S.L. has been exploited by British Resin Products, Ltd., who produce, among other products from C.N.S.L., "Epok" H.512 resin, which is extensively used in the preparation of insulating varnish. This resin is normally supplied by the makers in the form of solutions, as follows: 60 per cent. solution in white spirit; 70 per cent. solution in xylol 60 per cent. solution in pool rubber solvent. This resin is compatible with a wide range of film-forming materials, including drying oils, coumarone resin, urea lacquer resin, xylenol resins, ethyl cellulose, chlorinated rubber, Formvar, alkyd resins, "Epok" plasticiser A.461, dibutyl phthalate, tricresyl phosphate, and chlorinated diphenyl. H.512 has high solubility in aromatic and paraffinic hydrocarbons and chlorinated hydrocarbon solvents, and is soluble to a high degree in many other solvents, including esters and higher alcohols. Although the resin solutions gel in one hour at 150° C., the resin itself requires a minimum of 2½ hours at 150° C. to effect complete hardening, while correspondingly longer times are required to cure completely at lower temperatures. The following schedule was obtained by the makers of the resin by stoving

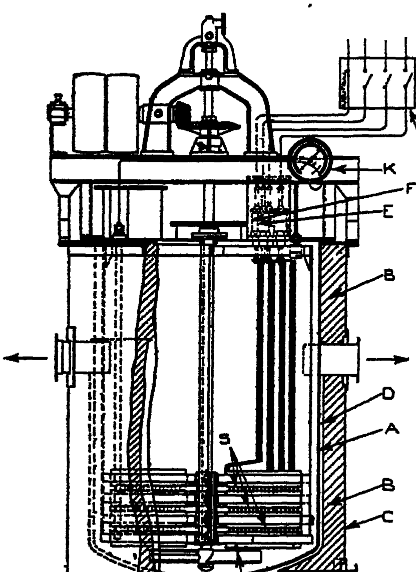

Fig. 5. Kestner Isoelectric plant.

C

Fig. 4. A finished piece of Bakelite resin.

10 grams of the solution in a 3-in. dia. petri dish:

Temperature C.	100°	110°	120°	130°	140°	150°
Gel time (hrs.)	—	—	5	2½	1¾	1
Curing time (hrs.)	60	30	15	8	4½	2½

Properties of the Cured Film

Cured films of H.512 show physical properties intermediate between those of the thermohardening phenolic resins and of the medium length oleo-resinous varnishes. They are tough, flexible, and resistant to mechanical and thermal shock. The resistance of cured H.512 to acids, alkalis, solvents and oils is unique among organic coating materials. Films are intact after 30 days' immersion in chemicals and solvents such as: 10 per cent. hydrochloric acid, battery sulphuric acid, waste nitrating acid, 30 per cent. caustic soda, acetone, butanol, Cellosolve, butyl acetate, petrol, and hot transformer oil. This resin is, however, slightly attacked by benzene and carbon tetrachloride. Its dielectric strength is high and compares favourably with that of good quality oleo-resinous insulating varnish films.

Good Penetration

Being soluble in the aliphatic petroleum solvents and hardened by polymerisation instead of oxidation, this resin possesses properties which make it superior to the oleo-resinous types as a basis for insulating varnish. Its physical and chemical properties are favourable for this application. Compared with oleo-resinous varnishes used for oil impregnation, varnishes based on this resin have, in general, good penetration into the closest windings. They harden without bubbling or blistering, and show excellent bridging and bonding properties. Such varnishes will not soften or throw out of high speed armatures, are resistant to

hot transformer oil, and protect the windings against the corrosive action of acid vapours and other chemicals. The resin alone can be diluted to a suitable viscosity for use as an insulating varnish, or it can be used in conjunction with other resins and oils which will modify its properties in a variety of ways.

Some of these modifications have proved to be of considerable interest. Varnishes based on these cashew resins have applications in most types of electrical insulation, since they have good penetration into the closest windings, curing properties in thick films and good mechanical and electrical properties when fully cured. These excellent advantages are not confined to varnishes based on cashew resins alone, but are shown by all suitably formulated oleo-resinous and black insulating varnishes to which a sufficiency of one of the cashew resins has been added.

Alkyd Resins

In the preparation of alkyd resins maleic anhydride plays a major role, while rosin in largely used in conjunction with this anhydride. Maleic anhydride was for some considerable time one of the few alkyd raw materials which combined both ethylenic unsaturation and condensation functionality in the molecule, but more recently alternative polymerisable and polymeric acids and alcohols have become available. Both pentaerythritol and polymerised glycerol are used in alkyd resinifications; while various types of modified alkyd resins are produced, such as by the incorporation of resins of the phenolic class with the alkyd type. Well established types of alkyd resins include maleic anhydride esters of glycerol, which may be produced by heating maleic anhydride with suitable glycerides, such as linseed oil, after which the product is esterified with a polyhydric alcohol to produce a resin which will form hard films on stoving.

Resin Plant

The increasing demand for synthetic resins and for varnishes, etc., which contain them has naturally been accompanied by large-scale production, and the plants recently put into service for this purpose are worthy of note. A typical example of such modern plant is the Isoelectric plant of

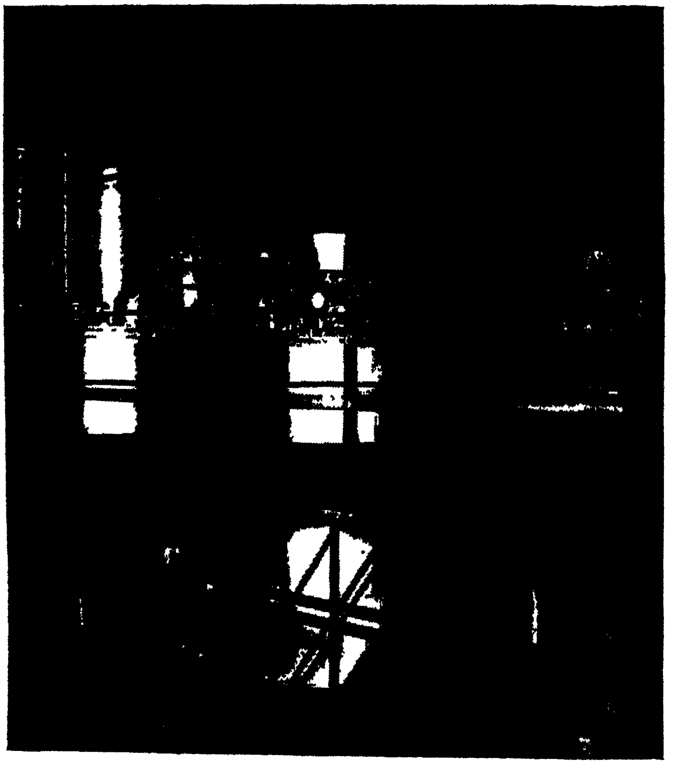

Fig. 6. A Kestner Isoelectric alkyd resin plant.

Kestner Evaporator & Engineering Co., Ltd., which is outlined in Fig. 5. In this system use is made of direct electric elements immersed in the fluid. The metal of which the elements are constructed is selected in each case not only for its electrical properties, but to suit the material being dealt with. Previously, oil and varnish pots have been heated direct by means of gas, oil or solid fuel. Either gas or oil can be thermostatically controlled better than solid fuels, but they have the great disadvantage, in general, of a tendency to overheat the product. The metal pot or vessel must come into direct contact with the products of combustion, and as a result, local overheating of the material may take place, while the bottom of the vessel sooner or later burns out.

These difficulties are avoided by placing the heat inside the vessel itself and within the material to be heated. Fig. 5 shows the electric elements for heating by three-phase current. The terminal box E is fitted with connections for three-phase with neutral at F. The elements in this instance are in strip form, arranged spirally, and superimposed one on the other as shown at S, which disposition ensures that thermic circulation causes most intense movement of the liquid in the vessel. Being on edge vertically, the strip provides the maximum surface for heating, yet the minimum resistance to flow of liquid in the upward and downward directions. The arrangement gives the necessary speed to the liquid over the surface and maintains an efficient circulatory system. Fig. 6 depicts a plant of this type installed in a varnish works. It is a Kestner alkyd resin plant with special vacuum condensing system. In such plants the temperature of the metal strip forming the heating elements is very much lower than that of the walls of an externally heated kettle, being only about 100° hotter than the product itself. The running cost of these plants, so far as heating is concerned, compares favourably with that of plants heated by other methods.

The principle of generating heat inside the kettle in direct contact with the product has a high efficiency and under normal works conditions at least 95 per cent. efficiency is obtained. The power consumption naturally varies with size of batch, bodying temperature, bodying time, etc., but is usually between 0.9 and 1.2 units per gal. of product. Taking a conservative figure of ¾d. per unit, the cost works out at roughly 0.6d. to 0.9d. per gal. Another type of plant for handling synthetic resins and their varnishes, by The London Aluminium Co., Ltd., is outlined in Fig. 7. This plant comprises an indirect-heated reaction kettle, stirring equipment, condenser, pumps, solvent mixing vat, etc., and may be constructed in mild steel, stainless steel, copper, nickel, aluminium, or light alloy.

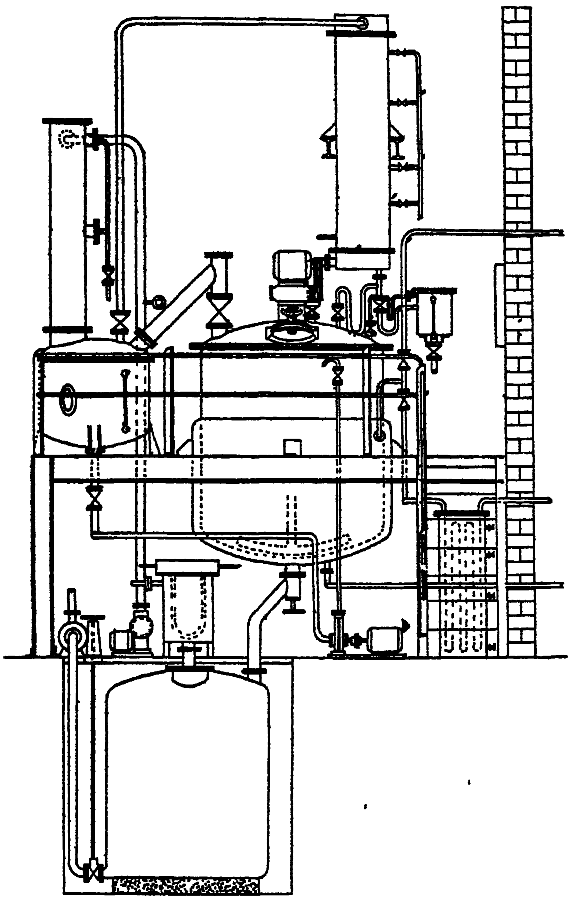

Fig. 7. Diagrammatic sketch of "Diamond" reaction kettle and auxiliary plant.

In plants of this description the choice of the most suitable metals, methods of fabricating and particularly the use of the correct technique in welding are of the greatest

importance towards withstanding the corrosive action of the reaction mixtures and thus yielding products of the highest quality. The use of fluid heating mediums, *e.g.*, circulating hot oil and diphenyl, leads to easy control of temperature, evenness of heating and rate of heating. The choice of heating method has to be made after a study of the various factors, such as installation costs, running costs, temperature range required, and grade of product desired.

Heat-Resistant Resins

For varnish making purposes the technological basis of phenolformaldehyde resins is concerned largely with the alkylated and arylated classes. Among the newer types of product may be noted the production of flame-resistant materials by an American process (U.S. Pat. 2,298,866), wherein phenols are condensed with chlorinated aralkyl phosphates. Bakelite resin R.10840 is an example of a 100 per cent. phenolic resin of the non-heat-reactive type and manufactured from British raw materials. It has the following physical properties: sp. gr. 1.17; m.p. 112-125° C.; colour (1 : 1 solution in toluol), not darker than No. 8 Gardner-Holdt. It lends itself readily to the production of oil varnishes with such oils as tung, linseed, etc. In admixture with tung oil it has good low-temperature gas-proofing properties and its slight gelation-retarding effect facilitates control in the varnish kettle.

A certain amount of initial cloudiness is apparent when the resin and tung oil are heated together, but this clears rapidly when the temperature reaches 230° to 240° C. These oil varnishes will air-dry overnight to give tack-free films. The addition of this resin greatly improves the resistance of linseed oil to water and solvents, but the air-dried films of its linseed oil varnishes tend to suffer from a very slight after-tack. This tendency to after-tack can be eliminated by adding about 25 per cent. of a quick-drying tung oil varnish.

New Synthetic Fibre

An All-British Discovery

IMPERIAL Chemical Industries and the Calico Printers' Association announce that a new truly synthetic textile fibre is now under investigation in I.C.I.'s laboratories. The advent of this new fibre, produced from a polyester derived essentially from terephthalic acid and ethylene glycol, marks another step in the application of fundamental scientific research to the controlled design of textile raw materials. The fibre, which is at present known as "Terylene," is the result of research work initiated by the Calico Printers' Association, and carried out in their laboratories by Mr. J. R. Whinfield, assisted by Dr. J. T. Dickson and others. The qualities of the polyester, and its potential value for fibre-making, were recognised by the C.P.A., and patents covering the inventions were taken out by them. The subsequent research work on the chemical polymer and its conversion into a textile fibre has been entrusted to I.C.I., who have acquired an exclusive licence covering the whole world outside U.S.A. It is a wholly British fibre.

"Terylene," it is hoped, will add to the range of attractive new textile materials. From a given sample of the parent polymer it is possible to produce multifilament yarns of widely different characteristics by varying the physical and mechanical operations of spinning and processing. Thus, for example, it is possible to obtain from the same polymer a yarn of low extensibility, but with outstanding high strength (eight grams per denier or higher), or one of increased extensibility, but with a lower strength.

Good Heat Resistance

Probably the most notable property of "Terylene" so far observed is its markedly high resistance to light and to heat. Another outstanding property is its high initial elastic modulus, so that a relatively high load is required to produce a small extension. This should permit "Terylene" to be readily woven or knitted. Like other fully synthetic fibres, "Terylene" is highly resistant to micro-organisms and bacteria. The general chemical resistance is good, particularly to acids and organic solvents and bleaching agents. It has a very low moisture absorption and does not swell in water. It can be heat-set to give stable yarns or fabrics, has good resilience and a high ratio of wet to dry strength. "Terylene" fabrics can be ironed, laundered and steam-pressed normally. The fibre presents problems in dyeing, and research on coloration is proceeding. Exceedingly fine filaments can be made, as well as heavy coarse filaments, giving a wide potential range in texture and types of fabrics. It can be expected that, later, "Terylene" will also be available in forms other than fibres such as monofils, film, extruded sections, and moulding powders.

Difficulties of Production

So far the development is in a preliminary stage in the laboratory, and it is here that these applications are being explored. Nevertheless, with the present difficulties in the supply of essential equipment and buildings, which are retarding all developments, it must inevitably be a matter of years rather than months before the final stage of evaluation is reached and the fibre is available to the textile industry in appreciable quantities.

Leather Chemists in Conference

Papers Read at the Leeds Meeting

THE annual general meeting of the British Section of the International Society of Leather Trades Chemists was held in the University, Leeds, on September 20-21. The president, Mr. F. H. Quinn, M.Sc., in opening the meeting, welcomed Professor P. Chambard, president of the Society, also Messrs. C. R. Loos, C. Monnet, S. G. Govier, Professor E. R. Theis, Mr. T. C. Thorstensen and others. He referred to the steady and continuous growth of the section, and said he was hoping eventually for an even wider degree of co-operation with other leather chemists' organisations.

A paper on "The Influence of Acids and Salts on the Properties of Sole Leather," by N. L. Holmes and G. E. Benskin, was read by Mr. Benskin. It dealt with investigations of the effects of varying salt concentrations and effective acidities in the region of those commonly found in practice on leather tanned in mimosa liquors. The properties examined included tensile strength, elastic modulus or rigidity, shrinkage temperature, substance changes of the wet leather and weight yield. Graphs and tables indicated that the salt concentration of liquors was as important to the control chemist as were tan contents and *p*H determinations.

Under the conditions obtaining for these experiments it was found possible to assess the relative effects of changes of *p*H and salt concentration on these properties. A difference in magnitude as small as 0.05 N. in the salt concentration was shown to have a profound effect on the wet rigidity of leather at *p*H values in the region of 3.0. The results of hot pitting leather under differing conditions of salt content and acidity were studied and the effect of salt concentrations was shown to be greater at 37° C. than at 16° C.

Connective Tissues

Dr. E. C. Bate-Smith's paper, which followed, was entitled "The Chemistry of Connective Tissue." From a chemist's point of view, he said, animal tissues presented a bewildering assembly of chemical substances, out of which some degree of order was gradually emerging. The connective tissues, by comparison with other tissues, such as muscle, had had little attention paid to them as yet, and the phase of preliminary sorting had not yet been completed. One rested at present on the histologist's tests for the differentiation of characteristic components, and the immediate task was to fill in the chemical details of this differentiation.

The histologist recognised three, and only three, fibrous components of the various categories of connective tissue: collagenous, elastic, and reticular. These were differentiated by morphological characters, *e.g.*, whether branched or unbranched, wavy or straight, and by staining reactions with various dyes or impregnating procedures, sometimes of a very complicated character. Chemical characterisation in an approximate sense had been achieved by examining tissues in which these components predominate, and from which extraneous matter, such as the ever-present amorphous ground substance, had been cleared as much as possible.

The connective tissues contained a great deal of material other than the substances of the fibres. The most important other protein constituent was a mucoid, variously termed tendomucoid, chondromucoid, etc., but which appeared to be the same from all types of connective tissue. This was probably the material of the amorphous ground substance, which was so elusive a component from the histological point of view. Further progress in the chemical characterisation of these constituents, especially the fibrous ones, needed in the first place the most meticulous separation of the recognised structural elements, resorting if necessary to microdissection for the purpose, and this may require the development of ultramicrochemical analytical methods to deal with the small quantities of material so obtained.

Salts of Chromium

"The Complex Salts of Chromium" were dealt with in a contribution by E. R. Theis and T. C. Thorstensen (read by Professor Theis). In this it was pointed out that the addition of oxalic acid to 33 per cent. basic chromium sulphate resulted in a strong penetration of the complex by oxalic acid or the oxalate anion. Spectrophotometric extinction curves showed two maximum absorption peaks in the near ultraviolet and visible portions of the spectrum. The spectral absorption was greater at 720 mμ than at 560 mμ. In both peaks there was a slight shift towards lower wave-lengths with increased addition of oxalic acid. The addition of formic acid resulted in a spectral curve having a higher absorption at 580 mμ than at 720 mμ, just the opposite of the oxalic acid complexes. It was also noted that the extinction values of the complex decreased with small additions of formic acid until a minimum value was reached. With further addition of formic acid, the extinction values increased slowly but steadily. Preliminary data has shown that cationic exchange resins can be used as an analytic tool for the study of various types of chromium complexes. The data given in-

dictated that the "formato"-chromium complexes are quite different from the "oxalato" complexes. These data indicated that formic acid in the molecular state penetrated the complex, while oxalic acid appeared to enter as the anion. The practical concept of moderate additions of sodium formate to chrome liquors was studied and discussed. It was stated that the addition of three moles of formate for each mole of Cr_2O_3 used will yield a finished leather having a smooth grain, a full and round leather, and possibly an increased yield.

Grease in Light Leather

The problem of grease in light leather manufacture was discussed by Dr. K. G. A. Pankhurst. It was satisfactorily solved only if dealt with at a very early stage in the leather-making process. Failure to deal with it in the pre-tanning period could not, with certainty, be remedied by a post-tanning treatment with petrol. Three main methods of pre-tanning degreasing were available, *viz.*: solvent extraction, aqueous emulsification, and pressure. The last process needed little explanation; solvent extraction and aqueous emulsification, however, involved many surface chemical actions which made their application more complex.

A necessary preliminary to degreasing was the rupture of the walls of the cells in which the fat is normally invested. This was usually accomplished by pickling and subsequent storage. Pickling also brought about the very necessary conversion of any calcium soaps, formed during any previous liming treatment, into removable free fatty acids.

Solvent extraction of pickled pelts (about 60 per cent. water) could be divided into three stages: (1) entry of the solvent into the pelt, displacing the water in contact with the fibres; (2) dissolution of the fat in the solvent and its diffusion out of the pelt; and (3) replacement of the solvent and residual dissolved fat by an aqueous solution. Stages (1) and (3) were mutually antagonistic, since any surface-active agent added to the solvent to bring about its entry into the pelt would militate against its subsequent replacement by an aqueous solution. The most satisfactory surface-active agent to use was one which, having assisted in stage (1), is hydrolysed by the acid of the pickle during stage (2) to form a compound with little or no affinity for the protein fibres of the skin. Sulphated amyl oleate is such a compound.

Degreasing by aqueous emulsification was best brought about by the use of non ionic surface-active agents, which were much less absorbed to the protein fibres than either of the two ionic types. Compounds such as condensates of ethylene oxide with long-chain molecules, *e.g.*, alcohols, were suitable. Vigorous mechanical action throughout any degreasing treatment was an essential to its success.

"Enzymes in the Pyrogallol Tannins," contributed by Dr. S. D. Sourlangas, was the concluding paper. Here it was shown that the deposition of bloom from pyrogallol tannin infusion was brought about through the hydrolysis of the tannins by an enzyme or enzymes native to the fruit themselves. These enzymes could be inactivated by damp-preheating of the fruits or by lowering the *p*H of the solutions to the region of *p*H 2.3. The valonia enzyme could be absorbed on to kaolin under specified conditions, and would also come off the kaolin into a tannin solution of *p*H 4.5, but not in any of the buffers tried.

It had been found possible to separate the enzyme from the various pyrogallol tannins, and their hydrolytic activity had been tested on some of the more common tannins of the same class, as well as on gallotannic acid. "Tannase" produced bloom not only from a heat-sterile valonia solution, but also from a valonia infusion which had ceased to deposit bloom. The exact mechanism of bloom deposition was discussed in some detail, and various suggestions put forward in the past were critically examined.

The quantitative determination of gallic acid by extraction with ether in a Forster extractor without any previous dialysis, but after the solution had been acidified, was put forward as the most reliable method of determining gallic acid in the presence of "interfering" substances such as the tannins. All the methods previously suggested were found to be of no great value, as the gallic acid was adsorbed together with the tannin on substances like hide powder, quinine hydrochloride, or gelatin.

The general properties of ellagic and chebulinic acids were discussed and the work of Freudenberg and Goldman on the titration curves of the latter acid was described, indicating that chebulinic acid possessed two free carboxyl groups.

BRITISH GUIANA TRADE

Big increases in the imports and exports of British Guiana for the six months ended July 31, 1946, compared with the similar period last year, is indicated in the *Commercial Review* of British Guiana. Imports of ammonium sulphate from Great Britain increased from 5,040 tons to 6,628 tons; cement from 12,584 barrels to 23,155; oil from 145,074 gal. to 249,458; while glass and glassware imports were $91,645 against $89,058 in 1945, and painters' colours and materials $146,003 against $144,226. Balata, gums, charcoal, gold and diamonds showed increased exports, while molasses increased from 176,750 gal. in 1945 to 1,889,282 gal. this year.

Institute of Welding

Expansion of Scope and Activities

IN his presidential address, delivered at a meeting of the Institute of Welding in London on October 2, Mr. Arthur Dyson referred to the high standard set by the past president, Mr. W. W. Watt, and the progress which the Institute had made in the past two years under his forceful and far-sighted leadership.

In that period membership had increased from 3252 to 5115; in 1943/44, the Institute's income was £4854 and the year closed with a deficit of £241; last year there was a surplus of £769 and the total revenue was £9541. In 1943/44 the Council and its principal committees met nine times, as against 24 last year. When Mr. Watt became president there were 11 branches; there are now 19, and last year there were 142 meetings organised by the Institute and its branches, as compared with 100 in 1943-44. Furthermore, under Mr. Watt's guidance the Welding Research Council was transformed into the British Welding Research Association, and the whole constitution of the Institute recast and reconstructed.

Issues of the Transactions of the Institute had been increased from three or four to six a year, as the first step towards giving the Institute something it had never yet had, a monthly journal of its own. Last, but by no means least, the regulations regarding membership had been entirely revised, so as to give every class of membership a known and enhanced technical significance.

Outlook for Welding

"It must," he continued, "be our constant aim to devise means of associating with the Institute's work in all its variety the largest possible number of members. The outlook for welding in this country is a very bright one, for I cannot believe that, in spite of the astonishing progress made during the war, we have as yet come within sight of exhausting the possibilities for the employment of the various welding processes. It is a commonplace that the whole world is crying out for goods of all descriptions. It is equally obvious that British industry must maintain the same high level of production which it achieved in the war years. There is still much to be told about the part which welding played in making possible that war-time achievement, and we can confidently expect that welding will be called upon to contribute more and more to the manufacture of everything made of metal—and even, as some of our members remind us occasionally, of things made of plastics!

If we are to attain the same sort of standing as the older institutions, the several grades of our membership must stand for definite and ascertainable degrees of technical and scientific accomplishment. I hope that during my year of office the scheme for an Associate-Membership examination will be completed and approved. A suitable examination scheme can hardly fail to set up a standard of technical education with regard to welding of which every technical college in the country will have to take account.

In particular, said Mr. Dyson, they wanted to work hand-in-hand with the British Welding Research Association, for they looked to the Association for answers to numberless technical problems crying out for investigation, and they could offer to the Association unrivalled opportunities for putting the results of their researches into the possession of those who needed them.

Catering for Craftsmen

After giving his audience an outline of the Institute's educational policy, Mr. Dyson pointed out that, unlike most other engineering institutions, they had a class of membership, the Associateship, open to craftsmen. He shared the hope that in course of time the Associateship would give status to those who held it, and would serve to guarantee their competence as craftsmen, and he welcomed the interest shown by an offer, recently received and now under consideration by the Council, to finance a special competition in practical welding, open to Associates. Another suggestion was that the Institute should sponsor a series of pamphlets or leaflets, somewhat on the lines of those issued during the war by the Advisory Service on Welding, but designed expressly to inform the practising welder.

Library Service

Commenting on the remarkable growth of the Institute's Library, the president looked forward to the time when a Technical Information Officer, in charge of a separate department of the library, would be the guide, philosopher and friend of all who sought information about the welding processes. He asked members to assist them by undertaking to provide abstracts on subjects for which they were qualified.

In conclusion, the president reminded members that it was the Institute's part to stretch out its hands to all concerned with welding in any way, and to forge strong links with all associated bodies. The Institute had built up, and was building up, the friendliest relations with their opposite numbers in other countries.

LETTER TO THE EDITOR

Peat Moss in Canada

SIR,—The August 3 issue of your journal has been subject to my continued study for over two weeks. The note on peat wax and the paper by Clement and Robertson have been especially interesting to me.

Since October, 1943, I did research work at the National Research Council on the utilisation of Canadian peat, muskeg and other national fibres. I attended the first International Flower Show in New York City, after five years' omission, in March of this year, and saw the demand for peat moss in the United States.

One of the uses for peat moss not mentioned in the Clement-Robertson paper is as an addition to Buna-S rubber mixes for making cheap floor tiles, moulded sponge rubber, and several other products.

I determined the wax content in over 40 samples of peat substance from different localities; and we have decided wax extraction is not economic in Canada in the face of competing petroleum and synthetic waxes and plastics.

There are many other topics that could be discussed, but time is short and the reason for this note is to congratulate you on the good journal you are publishing and to say that I am ready at any time to co-operate with Messrs. Clement and Robertson in the exchange of information regarding respective peat ideas.—Yours faithfully,

C. W. DAVIS, B.Sc., M.C.I.C.

240 Powell Avenue,
Ottawa, Ont.
September 16.

TIN CONFERENCE

With the purpose of considering the prospective world tin position and whether any continuous inter-governmental study of that position is necessary, an international tin conference was opened on Tuesday in the Royal Geographical Society Hall, Kensington Gore, London, S.W. The British delegation comprised: Mr. George Archer, of the Ministry of Supply (head of the delegation); Mr. E. Melville (Colonial Office); Mr. R. L. Hall (Board of Trade); and Mr. C. T. Crowe (Foreign Office). The delegation had a panel of advisers representing the producing, smelting and consuming sides of the tin industry; these advisers were: Mr. A. G. Glenister (with Mr. G. W. Simms as his alternate); Mr. J. Ivan Spens; Mr. W. J. Wilcoxson; Mr. E. V. Pearce; Mr. S. Cahn; and Mr. P. O. Williams. The joint secretaries to the British Delegation are Mr. W. Fox (Ministry of Supply) and Mr. D. Caplan (Board of Trade).

Hungarian Dyestuffs

New Production Programme

A PROGRAMME for the production of 40,000 kg. of aniline dyes a month, and smaller amounts of diazo and sulphur dyes, has recently been put into operation in Hungary. Five large firms, including the Pet Fertiliser Works and the Hungaria Chemical Works, are participating in the scheme, which may subsequently be extended to include indigo substitute dyes.

Hungary has hitherto been entirely dependent on imports for her dyestuffs, a factor that has hindered the development of her cotton and silk printing industries. In 1944, dyestuffs ranked ninth of Hungary's imports, with a value of 21,300,000 pengoes, of which the I.G. Farben. supplied 18,100,000 pengoes' worth and Switzerland 3,100,000 pengoes. Since the armistice, no supplies have been received from Germany, but imports from Switzerland have increased to a value of 400,000 Swiss francs a month.

Arsenic-Resistant Ticks

Controlled by Gammexane

THE arsenic-resistant form of the common blue tick, which has hitherto defied all attempts at eradication, has been brought under control by Gammexane, the British insecticide. The common blue tick, which causes immense damage to cattle, especially in the Eastern Cape and Natal, acts as a carrier for gall sickness and red water. It has developed an arsenic-resistant strain during the forty years since arsenical dipping first became standard farming practice. Other insects have built up a similar defence against recognised chemical insecticides. The phenomenon was first noticed in connection with waxy scale insects on citrus trees, which built up resistance even to the strongest doses of cyanide.

Early research on the problem of the blue tick, undertaken at Rhodes University College, Grahamstown, showed that continual dipping in arsenical washes only increased the number of arsenic-resistant strains on the cattle. In a subsequent search for alternative treatment, by entomologists of African Explosives and Chemical Industries, the success of Gammexane was demonstrated. Large-scale dipping trials proved that three consecutive weekly treatments with dips containing only 50 parts of Gammexane per million rid the cattle of all lice and ticks, which dropped off in hundreds, leaving only a few "seed" ticks.

As in every instance where Gammexane has been used on domestic animals, the beasts suffered no ill effects. Oxen were inspanned immediately after treatment, and there was none of the marked drop in milk yield which follows arsenical dipping.

Personal Notes

Dr. E. Taberner has been elected president of the South African Chemical Institute.

Mr. S. R. Tailby has been appointed lecturer for the daytime course in chemical engineering at Battersea Polytechnic.

Dr. D. M. Wilson has left I.C.I., Ltd. (Explosives Division), to become lecturer in chemical engineering at Birmingham University.

Dr. R. A. Peters, Whitley Professor of Biochemistry in the University of Oxford, has been appointed a member of the Medical Research Council.

Mr. Leopold Friedman, managing director of De La Rue Gas Development, Ltd., has been appointed a director of Thomas De La Rue & Co., Ltd.

Dr. J. T. Dickson, who helped discover the new synthetic fibre Terylene (see page 446 of this issue), has joined the staff of Imperial Chemical Industries.

Mr. F. W. Archer and Mr. J. M. Kershaw, who have joined the chemical engineering staff of Monsanto Chemicals, Ltd., were formerly with the Admiralty and the Indian Government Service respectively.

Mr. Stanley Robson has been appointed to the Mineral Development Committee set up by the Minister of Fuel and Power to inquire into the resources and development of Britain's metalliferous and other minerals.

Professor R. A. Peters, Professor of Biochemistry at Oxford, visited Belgium at the invitation of the Société de Chimie Biologique and under the auspices of the British Council, to lecture to the Congress of Biochemists which was held at Liége from October 3-6.

Dr. B. A. Kilby, M.A., F.R.I.C., who has been appointed to a lectureship in biochemistry at Leeds University, has been working for the Medical Research Council for the past two years on the synthesis of penicillin with Professor A. R. Todd, at Cambridge.

Sir Wilfrid Ayre, chairman of the British Shipbuilding Research Association, and director of several shipping companies, has been appointed to the vacant seat on the Iron and Steel Board. He is a younger brother of Sir Amos Ayre, who was chairman of the Hydrocarbon Oil Duties Committee.

Mr. D. T. Flood, M.Sc., F.R.I.C., who has been appointed director of the new Institute of Industrial Research and Standards in Eire, assisted during the war in the establishment of chlorate and phosphorus plants for the Army. From 1926 to 1934 he was engaged in technical research work at Yale University, U.S.A. He also worked for a time on research work in the petroleum and rubber industries.

Dr. W. J. Donaldson, B.Sc., Ph.D., lecturer in chemistry at Constantine Technical College, Middlesbrough, has been appointed lecturer in chemistry at Robert Gordon's Technical College, Aberdeen. Graduating at Edinburgh University, he was awarded his Ph.D. degree for research on colloid and physical chemistry. He became a demonstrator at Edinburgh University and later chemistry master at the Royal High School, Edinburgh. During the war he was seconded to I.C.I.

Obituary

Dr. Norman Lindsay Sheldon, Ph.D., C.I.E., F.R.I.C., who died on October 4, aged 70, at his home near High Wycombe, Bucks., had spent most of his active career in chemical industry in India. Appointed chemical engineer (1903) and manager (1915) of a Government cordite factory in India, he became Superintendent of the Acetone Factory, Nasik, in 1919, and Chief Inspector of Explosives, India, in 1920. He retired in 1932. His Fellowship of the Royal Institute of Chemistry dated from 1907, and he was elected to the Council of the Institute in 1940.

Sir Frank Heath, G.B.E., K.C.B., who died in London on October 5, aged 82, though not himself a scientist—he was at one time Professor of English at London University—had done as great service to British scientific industry as any of his more technological colleagues. It was through his iniative and administrative skill that the Department of Scientific and Industrial Research was established soon after the outbreak of war in 1914, and he served as its secretary from 1916 to 1927. In 1925 he visited Australia and New Zealand to strengthen the bonds between the D.S.I.R. and corresponding organisations in those Dominions, and his reports were followed by Acts of Parliament embodying his proposals. He was also a Governor of Imperial College and was a vice-chairman of the general council of the British Standards Institution (chairman 1938-9).

Professor Ignacy Moscicki, who died at Versoix, Switzerland, on October 2, aged 78, was best known as the president of Poland who urged his country to resist the Germans to the utmost in September, 1939. He began his career, however, as a chemist, having studied at Plock and at Warsaw before taking up an appointment in the faculty of chemistry at Riga Polytechnic in 1887. Returning to Warsaw in 1891, he incurred the suspicion of the Russian authorities for his share in the Polish movement of independence and was driven into exile.

After a period in London he migrated to Switzerland, where he worked on the chemistry of nitrogen with Professor Kowalski, at Vevey and at Fribourg University, and developed the "whirling arc" process for the production of nitric acid. In 1908 he was approached by the Aluminium Industrie A.G. of Neuhausen, and undertook the erection of a nitric acid plant and absorption towers at their new works at Chippis, effecting many improvements in subsequent years. In 1913 he became Professor of Chemistry at Lwow University (then under Austrian rule), where he occupied himself with the chemistry of petroleum and cognate chemical engineering problems. His second nitrogen plant was erected at Bory-Jaworzno, Poland, in 1921. Even more important, perhaps, was his share in the organisation of the State Chemical Works at Chorzow, where he remained in charge until Pilsudski called him to Warsaw in 1926 to be the President of the Polish Republic. Forced to flee to Roumania in 1929, he suffered a breakdown in health and was allowed to proceed to Switzerland, where he assumed Swiss nationality.

General News—From Week to Week

Cobalt oxide, crude or refined, may now be imported from any country without individual import licences, according to a Board of Trade announcement this week.

Among gifts and samples of British manufacture which Lady Cripps took with her to China when she left Dorset in a flying boat on Saturday were 10,000 M. and B. tablets which May & Baker, Ltd., provided for distribution among hospitals.

A scientific study of the possibilities of using lean whale meat for human food is to be made by a team of scientists who are sailing for the Antartic this month under the auspices of the Department of Scientific and Industrial Research.

Illustrations to I.C.I. advertisements will be included in an exhibition which is to be held under the auspices of the Central Institution of Art and Design at the Suffolk Galleries, London, from October 18 to November 9.

About sixty firms exhibited at the Welsh Industries Fair at Cardiff last week. The organisers consider the fair to have been about five times as successful as the fair held in May, the total attendance having been estimated at 80,000.

A Fuel Economy Conference is to be held at The Hague from September 2-10 next year, arranged by the Netherlands National Committee of the World Power Conference. Intending participants are invited to apply for further particulars to the British National Committee, World Power Conference, 36 Kingsway, London, W.C.2.

The Colonial Office has announced the institution of Colonial Research Fellowships to encourage qualified scientists to give special attention to colonial problems and to enable them to pursue research in the British colonial empire. Application forms and full information are obtainable from the secretary, Colonial Research Committee, Palace Chambers, Bridge Street, London, S.W.1.

Platinum is stated to have been sold this week at £22 per troy ounce by a leading London metal dealer; this is a fall of £1 5s. from the previous level of £23s. 5s. maintained on the London Metal Exchange.

More than twenty resolutions, covering numerous aspects of trade and commerce, will be discussed at the autumn conference of the National Chamber of Trade at the Assembly Hall, Tunbridge Wells, on October 23-24.

A strike of about 400 employees of J. and J. White, Ltd., Shawfield Chemical Works, Glasgow, followed the dismissal by the management of men declared to be redundant, and including furnacemen. It is intended to carry through a reorganisation scheme in the furnace department involving the disposal of some 80 workers.

The Performing Right Society, Ltd., 33 Margaret Street, London, W.1, points out that owners of factories and canteens should obtain from the society without delay the licence now necessary if "Music While You Work" and other copyright music is to be enjoyed without danger of infringement of copyright or liability to legal proceedings.

The current issue of "600," house journal of George Cohen, Sons & Co., Ltd., and associated companies, contains not only the customary house news and pungent humour (including quite a good joke against the modern chemist), but also some remarkable photographs, among which is a reproduction of the remarkable Kodak photomicrograph of a hexamethylbenzene molecule.

Almost half the available factory space in Short's premises at Rochester has been allocated by the Board of Trade to three firms: B. & P. Swift, Ltd., (automatic scales, gears, hydraulic pumps); Elliott Bros. (London), Ltd. (electrical and mechanical precision instruments); C.A.V., Ltd. (fuel injection pumps, electrical equip ment).

Trade buyers attending the "Britain Can Make It" Exhibition at the Victoria and Albert Museum, South Kensington, London, need no longer wait in queues with the public to gain admission, but can obtain priority admission between 9.15 and 10 a.m. daily on presentation of their trade card at the inquiry desk at the Exhibition Road entrance to the museum.

A £500,000 development scheme has been undertaken by the Alloa Glass Work Co., Ltd., Alloa, Clackmannanshire, which specialises in glass containers of all kinds. All the company's furnaces are to be redesigned on a new and enlarged scale and modern glassmaking machinery from America is being introduced. The first shop should be completed in ten months' time and the whole project should be finished by 1950—the 200th anniversary of the glass industry in Alloa.

Foreign News

Newfoundland's iron-ore production amounted to 984,645 tons last year, as compared with 464,371 tons in 1944.

Russia and Sweden have concluded a trade agreement, details of which will be made known later.

The 125th anniversary of the founding of McGill University, Montreal, was celebrated on Saturday.

Sierra Leone produced 705 tons of chromite in the second quarter of this year. No chromite was mined in the corresponding quarter of 1945.

Thirty-two new members were elected to the Chemical, Metallurgical and Mining Society of South Africa during the year ended June 30 last.

The completion, in January of last year, of a vanadium extraction plant in Peru, has resulted in a 20 per cent. increase in vanadium output in 1945.

The Siamese Government has notified the U.S. State Department that it would welcome the participation of American capital in the development of the country's mineral wealth.

We have just received the first two issues (July and August, 1946) of a new Review of Metallurgy—*Hutnické Listy*—published at Brno, Czechoslovakia. Accompanying the original articles are brief summaries in Russian, English, and French.

It is estimated that output of metals in the Belgian Congo this year will not reach last year's level. Copper production is expected to total about 130,000 tons, against over 160,000 tons last year; and tin output is estimated at 15,000 tons, compared with 17,350 tons in 1945. Output of tungsten might, however, show a small increase.

Canadian and United States interests are reported to have opened negotiations regarding the establishment of a zinc refinery in Quebec.

Negotiations are reported to have been concluded in Buenos Aires for the purchase, by the United States, of approximately 30,000 tons of linseed oil, at a price at least 10c. a lb. over the present American ceiling price of 27-28c.

A crisis has recently developed in the Sicilian sulphur mining industry, due, in the main, to a decline in sales. Because of financial difficulties, the "Imera" concern, which operates the two important mines at Trabia and Tallarita, has suspended work.

Under the terms of a new trade agreement between Switzerland and Yugoslavia, Swiss chemical and pharmaceutical products, as well as dyestuffs, machinery and apparatus, will be exchanged against ores, timber and other raw materials.

Pre-war plans for the establishment of hydrogenation plants are again being discussed in the Belgian coal mining industry, especially by enterprises in the Charleroi region. Should these plans materialise, it is expected that a number of basic chemical products will be manufactured.

Experiments on underground gasification of coal are being carried on at the Bois-la-Dame collieries in the Campine coalfield of Belgium. Depending on the result of these, a programme will be drawn up for the whole of the Belgian coal-measures, in accordance with the geological conditions obtaining.

A trade agreement between Austria and Poland, in force for the next six months, provides for an exchange of goods to the value of $7,200,000: Poland will mainly export coal, zinc, and other mineral products, while Austria will deliver metallurgical machinery.

Recent prospecting for gypsum in France—as a raw material for sulphur production—has revealed two rich deposits in Provence, says *L'Industrie Chimique,* the calcium sulphate being present in its anhydrous form, much the most suitable for the purpose required. One deposit is in the Buëch valley, tributary to the Durance; the other is located in the Var, between Toulon and Brignoles.

Production of aluminium at the new Norwegian works at Aardel will not begin before the second half of next year. The works were planned and built by the Germans at a cost of Kr.200,000,000, and it is estimated that production costs will amount to Kr.1427 per ton. Annual output will aggregate about 12,000 tons per annum, thus bringing the country's aluminium output up to about 50,000,000 tons per annum.

According to a Swiss report, a British industrialist is negotiating with the Danish Ministry of Industry on the erection of a large steel plant near Copenhagen. The required capital of about 120,000,000 Kroner is to be raised jointly by Swiss and British interests. A weekly output of 300 tons is envisaged, and the works should provide employment for some 500 men.

Canadian exports of chemicals and allied products for the first seven months of this year were $38,900,000, as compared with $75,000,000 for the same period in 1945 and $20,600,000 for the 12 months of 1939 Other products whose exports were reduced this year compared with last, were iron $139,100,000 ($421,600,000 in 1945), non-ferrous metals $126,900,000 ($226,200,000 in 1945), and non-metallic minerals $26,900,000 ($35,200,000 in 1945).

The Otanmaki iron ore deposits in the North of Finland are to be exploited. A Finnish civil engineer is to visit the United States in order to consult with American experts regarding the processing of iron, titanium and vanadium ores. He will also study the possibilities of obtaining American smelters and steel plant. The ores, which consist mainly of magnetic and ilmenite, are said to have an average iron content of 28 per cent. and a considerable percentage of vanadium.

Forthcoming Events

October 15. Society of Dyers and Colourists (Huddersfield section). Field's Cafe, Huddersfield, 7.30 p.m. Mr. H. Boothroyd: "Textile Production and Dyeing in Denmark and Sweden."

October 15. Institution of the Rubber Industry (London Section). Waldorf Hotel, Aldwych, London, W.C.2, 6.30 p.m. Mr. R. C. W. Moakes: "A Preliminary Evaluation of Synthetics in Rubber-to-Fabric Adhesion."

October 15. British Society for International Bibliography. Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2, 2.30 p.m. Dr. B. M. Crowther: "The Use of the Universal Decimal Classification in Periodical Abstracting Services for Scientists and Engineers"; Dr. S. C. Bradford: "The Problem of Complete Documentation in Science and Technology."

October 16. Institute of Welding (North London branch). Technical College, Acton, W.3, 7.30 p.m. Dr. J. H. Paterson: "Development of the Modern Electrode."

October 16. British Association of Chemists (London Section). Gas Industry House, 1 Grosvenor Place, London, S.W.1, 7 p.m. Mr. J. H. F. Smith: "Fire and Explosion—I."

October 16. Royal Institute of Chemistry (London and South-Eastern Counties section). London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1, 6.30 p.m. Dr. W. E. van Heyningen: "The Publicity of Science by Radio."

October 16. Society of Chemical Industry (Agriculture Group). Physical Chemistry Lecture Theatre, Royal College of Science, South Kensington, London, 2.30 p.m. Dr. F. Gross: "An Experiment in Farming the Sea."

October 16. British Association of Chemists (Liverpool section, jointly with the Association of Scientific Workers). Stork Hotel, Queen Square, Liverpool, 6.45 p.m. Conference on "Salaries and Working Conditions in the Chemical Industry." Speakers: Dr. McMorgan, chairman, Manchester branch, A.Sc.W.; Mr. F. Crone, area organiser, A.Sc.W.; Mr. Stewart Cook, organising secretary, B.A.C.; Mr. H. H. Hutt, chairman, Liverpool section, B.A.C.

October 17. The Chemical Society. Municipal College, Southampton, 7 p.m. Dr. H. J. Emeléus: "Chemical Aspects of Work on Atomic Fission."

October 17. The Chemical Society. The University, Western Bank, Sheffield, 2.30 p.m. and 6 p.m. Professor Jaroslav Heyrovsky: "The Principles and Applications of Polarography."

October 17. Oil and Colour Chemists' Association (London section). Royal Institution, 21 Albemarle Street, London, W.1, 6.30 p.m. Professor H. W. Melville: "The Chemistry of High Polymers—III."

October 17. The Chemical Society. Burlington House, Piccadilly, London, W.1, 7.30 p.m. Mr. R. A. Baxter, Mr. G. T. Newbold and Mr. F. S. Spring: "Pyrazine Derivatives"; Mr. L. J. Haynes, Mr. E. R. H. Jones and Mr. M. C. Whiting: "Researches on Acetylenic Compounds : Acetylenic hydroxy-acids and their Reactions."

October 18. Association of Special Libraries and Information Bureaux (Northern branch). Hornby Library, William Brown Street, Liverpool, 3, 3 p.m. Mr. A. B. Agard Evans: "Information Service and the Export Trade."

October 21. The Chemical Society (jointly with the Royal Institute of Chemistry, S.C.I., and the Bureau of Abstracts). London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1, 6 p.m. Dr. G. M. Dyson: "A New Notation for Organic Chemistry."

October 22. Hull Chemical and Engineering Society (jointly with Yorkshire section of S.C.I.). Church Institute, Albion Street, Hull, 7.30 p.m. Mr. T. Andrews: "Modern Trends in the Whaling Industry."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

STEWART PLASTICS, LTD., Teddington. (M., 12/10/46.) September 11, £1750 debentures; general charge (except etc.)

BORAX CONSOLIDATED LTD., London, E.C. (M., 12/10/46.) September 9, Trust Deed dated September 2, 1946, securing £1,500,000 debenture stock with redemption premium diminishing from 104 per cent. to 101 per cent.; general charge (subject to etc.) *£2,500,000. April 16, 1946.

FLEETWOOD CHEMICAL CO., LTD., London, S.E. (M., 12/10/46.) September 12. Land Registry charge, to Barclays Bank. Ltd., securing all moneys due to or to become due to the Bank; charged on Camgate Farm Works, Long Lane, Stanwell. *£1970 December 31, 1943.

J. EVERSHED & SON, LTD., Brighton, soap and candle manufacturers. (M., 12/10/46.) September 11, £10,000 charge, to E. H. Kempe, Brighton; charged on 16 and 18 Chanctonview Road, Worthing; 7 and 9 High Street, West Tarring; 2a Blatchington Road and 61 Sackville Road, Hove; 52 St. George's Road, Brighton; Robertsbridge Stores and "The Chequers," High Street. Robertsbridge; and 201 Battle Road, St. Leonards-on-Sea. *£10,000. May 18, 1946.

Satisfaction

MIDLAND TAR DISTILLERS, LTD., Birmingham. (M.S., 12/10/46.) Satisfaction September 19, of debenture stock registered August 6, 1936, to the extent of £8500.

New Companies Registered

Cressett (Hersham), Ltd. (420,616).—Private company. Capital £5000 in £1 shares. Manufacturers of and dealers in chemicals, plastics, etc. Subscribers: M. K. Chaplin: A. W. Sampson. Registered office: 87 Regent Street, W.1.

Douglas Marshall, Ltd. (420,153).—Private company. Capital £100 in £1 shares. Manufacturers of and dealers in chemicals, disinfectants, dyes, etc. Directors: A. D. Marshall: L. Marshall. Registered office: 10-12 Copthall Avenue, E.C.2.

Far East Exports, Ltd. (420,622).—Private company. Capital £500 in £1 shares. Manufacturers and exporters of chemicals, drugs, disinfectants, fertilisers, etc. Subscribers: E. J. Edwards; E. R. Pinnell. Registered office: 22 Charing Cross Road, W.C.2.

B.E.P. Products, Ltd. (420,131).—Private company. Capital £100 in £1 shares. Manufacturers of and dealers in chemicals. gases, drugs, etc. Directors: P. L. Braithwaite; A. H. Preston; W. A. Edwards. Registered office: 5 Gregory Street, Loughborough.

Epsylon Research & Development Co., Ltd. (420,245).—Private company. Capital £100 in £1 shares. Chemical engineers, manufacturers of and dealers in chemical apparatus, etc. Subscribers: F. C. S. Tufton; A. W. Paterson. Solicitors: Simmons & Simmons, 1 Threadneadle Street, E.C.2.

Company News

The interim dividend of **Greeff-Chemicals Holdings, Ltd.**, is announced as being 3¾ per cent., as compared with 3 per cent. last year.

The nominal capital of **Anglo Chemical & Ore Co., Ltd.**, Palmerston House, E.C.2, has been increased beyond the registered capital of £5000 by the addition of £5000 in £1 ordinary shares.

Petrochemicals, Ltd., River Plate House, South Place, E.C.2, has increased its nominal capital beyond the registered capital of £1000 by the addition of £4000 in £1 ordinary shares.

The lists of applications for the offer for sale at 51s. of 301,960 "A" ordinary £1 shares of the **Morgan Crucible Co., Ltd.**, were closed on Wednesday last week, the offer having been heavily over-subscribed. Permission has been granted to deal in the new shares, after allotment, and in £400,000 "A" ordinary stock.

Chemical and Allied Stocks and Shares

STOCK markets have continued the better tendency which developed at the close of last week, buyers being attracted by the good yields on a large range of leading industrial shares, while the better Peace Conference news also assisted sentiment. The firmness maintained by British Funds was helpful, and, moreover, the majority of dividend announcements that have come to hand were regarded as encouraging. Best prices were not held, but the rally was most marked in the industrial section, where renewed buying of colliery shares on estimates

of the eventual compensation values was a feature.

Imperial Chemical strengthened 6d. to 42s 3d. and Calico Printers were 9d. higher at 24s. on the new textile fibre news. Dunlop Rubber have been firm at 70s. 6d.; Lever & Unilever strengthened to 51s. on dividend estimates. Elsewhere, Greeff-Chemicals Holdings 5s. shares were 12s. following the raising of the interim dividend from 3 per cent. to 3½ per cent. In respect of the whole of the past year, the total payment of the latter company was increased from 11 per cent. to 12½ per cent. There was again a fair amount of activity around 5s. in the 2s. shares of Major & Co. B. Laporte were 98s. 9d., Monsanto Chemicals 5½ per cent. preference 25s., Fisons 55s., and Lawes Chemical 10s. ordinary 13s. 3d. Sanitas 9 per cent. £1 preference were 40s. and British Alkaloids 1s. ordinary 13s. 9d. Turner & Newall rallied well to 81s. 9d. on higher dividend hopes. General Refractories recovered to 18s. 7½d., United Molasses to 49s., while British Aluminium at 40s. 6d. were better. Triplex Glass, after the sharp decline which followed the halving of the dividend, showed a partial recovery at 35s. on expectations that the full results will show that a strong financial position has been maintained and give grounds for the view that earning power will recover in due course. Morgan Crucible £1 " A " ordinary shares, issues last week at 51s., commenced dealings at 1s. premium and are ranked as a sound industrial in view of the good dividend record and balance-sheet position.

In the coal-iron section, Carlton Main 41s. 3d., Bolsover 61s., Powell Duffryn 25s. 1½d., Shipley 42s. 6d., and Staveley 56s. 9d. were prominent. Guest Keen improved to 41s. 10½d., United Steel to 25s. 1½d., and Babcock & Wilcox rallied well to 60s. Allied Iron were 57s. 9d. and Stewarts & Lloyds 50s. 1½d. Low Temperature Carbonisation 2s. ordinary, which remained under the influence of the progress report, improved further to 3s. 9d. Tube Investments showed firmness at 118s. 9d. In other directions, Borax Consolidated were firmer at 42s. 6d., De La Rue £12 13/16, Distillers 130s. 6d., and there was a better trend in paint shares, Pinchin Johnson being 44s. 6d., Goodlass Wall 10s. ordinary 28s. 7½d., and, in response to hopes of a higher dividend, Lewis Berger strengthened to £6 9/16.

Boots Drug rallied well to 58s. 6d. following an earlier reaction. Beechams deferred were 25s., Griffiths Hughes 59s., and Sangers 32s. Dubarry Perfumery 1s. shares held firm at 6s. 9d. on the dividend. Rayon shares strengthened under the lead of British Celanese at 32s. Shares of the Cementation Co. have improved to 6s. 1½d., Plaster Products 5s. ordinary to 13s., while British Plaster Board 5s. ordinary were 32s. 9d. and Associated Cement rallied to 62s. 6d. Oils were better inclined, Shell being 89s. 4½d. British Borneo Petroleum, after an earlier decline, recovered 2s. 6d. to 30s. 9d., while gains were recorded by Mexican and Canadian Eagle; Lobitos rose to 65s. on higher dividend hopes.

British Chemical Prices

Market Reports

THERE has been little change in the general trading conditions on the London chemical market during the past week and all sections of the market have continued firm, with new business on a moderate scale. Spot transactions are difficult to negotiate in a number of directions owing to tightness in supplies, but with regard to deliveries against contracts the movement is steady and, in the aggregate, fairly substantial. In the general run of the potash and soda products the demand has been more than sufficient to cover the quantities on offer, and a considerable export inquiry remains in circulation. There has been a steady call for oxalic acid, acetic acid and sulphuric acid, and an active demand is reported for white powdered arsenic, formaldehyde and sulphate of alumina. There has been no easing in the pressure for the lead compounds and quoted rates are firm. Very firm price conditions obtain in the coal-tar products section and the demand in most cases exceeds available supplies.

MANCHESTER.—Firm price conditions have been maintained in virtually all sections of the Manchester chemical market, but while the tendency is upward in a number of directions there has not been much actual change on balance for the week. Among the soda products, caustic, soda ash, bicarbonate, and sulphate are meeting with a steady demand on the home market, and deliveries of ammonia and magnesia compounds have been fully maintained at their recent levels. The mineral acids are meeting with a good demand. Shippers have also been in the market for a fairly wide range of products, though in several directions export business is not easy to arrange. A moderate flow of new orders has been reported in the tar products section and deliveries against old business in the leading light and heavy classes account for substantial quantities.

GLASGOW.—Very little change has been shown in trading in the Scottish heavy chemical market during the past week. A heavy demand for all classes of chemicals has been registered, both for spot and forward deliveries. Deliveries against contracts are well up to standard. In the export market a large demand for formaldehyde, Glauber salts, zinc oxide, sulphuric acid, sulphur and tanning chemicals has been experienced. Prices are very firm and the supply is no easier than in the past.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Liquid flow control.—Aluminium Plant & Vessel Co., Ltd., and H. F. Goodman. 27399.

Welding metals.—Aluminium Plant & Vessel Co., Ltd., W. K. B. Marshall, and J. F. Lancaster. 27703.

Weed-killing compositions.—American Chemical Paint Co. 26489.

Aluminium, etc., coatings.—American Chemical Paint Co. 26896.

Resinous materials.—American Cyanamid Co. 26697-8.

Biguanides.—American Cyanamid Co 27015-21.

Catalysts.—C. Arnold. (Standard Oil Development Co.) 26906.

Volatile fuels.—C. Arnold. (Standard Oil Development Co.) 26907.

Hydrocarbons.—C. Arnold. (Standard Oil Development Co.) 26908.

Treatment of gaseous mixtures.—C. Arnold. (Standard Oil Development Co.) 26909.

Hydrogen mixtures.—C. Arnold (Standard Oil Development Co.) 27050.

Nitro-compounds.—Boots Pure Drug Co., Ltd., J. Cymerman, and W. F. Short. 27043.

Magnesium base alloys.—R. M. Bradbury. 26668.

Aluminium alloy.—R. M. Bradbury. 26669.

Treatment of viscose products.—British Celanese, Ltd. 26590.

Dyestuffs.—Ciba, Ltd. 27027-8.

Refining of aluminium.—Compagnie de Produits Chimiques et Electrométallurgiques Alais, Froges, & Camargue. 26468.

Triple superphosphate.—Davison Chemical Corporation. 26753.

Polymeric materials.—E.I. Du Pont de Nemours & Co. 26842.

Dyestuffs.—General Aniline & Film Corporation. 27070-1.

Carboxylic acids.—B. F. Goodrich & Co. 26440-2.

Carboxylic acid compounds.—B F. Goodrich Co. 26579-82.

Organic compounds.—B. F. Goodrich Co. 26696.

Polycarboxylic acids.—B. F. Goodrich Co. 26821-2.

Cellulose solutions.—Heberlein & Co., A.G. 26827.

Chemical reaction process.—International Pulverising Corporation. 26759.

Polymerisation processes.—Mathieson Alkali Works. 26921.

Bauxite regeneration.—N.V. de Bataafsche Petroleum Maatschappij. 26498.

Vitamin compounds.—N.V. Organon. 26911-2.

Emulsions.—National Chemical Products Proprietary, Ltd. 26895.

Emulsion breaking apparatus.—C. E. North, and A. P. North. 26839.

Insecticides.—Pan Britannica Industries, Ltd., and E. J. N. Cakebread. 26406.

Polyene alcohols.—Roche Products, Ltd. (F. Hoffmann-La-Roche & Co., A.G.) 26789.

Acid derivatives.—Roche Products, Ltd., F. Bergel, A. L. Morrison, A. R. Moss, W. H. Kennedy, M. Königstein, and H. Rinderknecht. 26522.

Dinitroresorcinol.—L. Rubinstein, and I.C.I., Ltd. 26540-1.

Dinitroresorcinate.—L. Rubinstein, and I.C.I., Ltd. 26542.

Hydrocarbon materials.—Yorkshire Tar Distillers, Ltd., D. W. Milner, and E. C. Holdsworth. 26568.

Nitropolystyrene.—H. Zenftman, A. McLean, and I.C.I., Ltd. 26539.

Complete Specifications Open to Public Inspection

Polyethylene-oxidation inhibitor.—Bakelite Corporation. March 17, 1945. 7257/46.

Anti-oxidants for polyolefins.—Bakelite Corporation. March 17, 1945. 7578/46.

Preparation of alkylhalogenosilanes.—British Thomson-Houston Co., Ltd. March 15, 1945. 7245/46.

Alkylation of halogenosilanes.—British Thomson-Houston Co., Ltd. March 15, 1945. 7246/46.

Process for the manufacture of insulating materials against heat and cold.—Bumax Werke A.G., Durrenasch. March 12, 1945. 34532/45.

Process of manufacturing a composition from waste liquor of cellulose.—Celludur, A.G. March 26, 1942. 11950/42.

Oxide layers obtained upon aluminium and its alloys by electrolytic means.—Cie. de Produits Chimiques et Electro-Métallurgiques Alais, Froges et Camargue. Nov. 11, 1943. 28064/45.

Preparing a material which has a high content of carotin.—Cooperatieve aan en Verkoopvereeniging Centraal Bureau vit het Nederlandsche Landbouw-Comite, G.A. Oct. 17, 1941. 24028/46.

Colouring materials.—E.I. Du Pont de Nemours & Co. March 14, 1945. 7839/46.

Manufacture of long-chain carboxylic acids.—E.I. Du Pont de Nemours & Co. March 17, 1945. 8311/46.

Recovery and utilisation of tin.—Hanson-Van Winkle-Munning Co. May 21, 1943. 12203/44.

Electric insulating oil and methods of preparing the same.—O. A. Harlahti, and C. A. F. Gustafsson. March 14, 1945. 21660/46.

Expression of liquids from solids, and in particular to the expression of oil from oil-bearing materials.—Lever Brothers & Unilever, Ltd. Jan. 21, 1943. 25561/46

Complete Specifications Accepted

Process for removing organic sulphur compounds from gases.—Gas Research Board, and A. Key. Feb. 26, 1945. (Addition to 561,679.) 580,474.

Manufacture of piperidino-ethanol ester of di-*n*-butylacetic acid.—J. R. Geigy, A.G. Aug. 4, 1943. 580,392.

Acetylene tetraesters of alpha-methylene monocarboxylic acids and polymers and copolymers thereof.—I.C.I., Ltd. Oct. 16, 1943. 580,469.

Process for the manufacture of a protein plastic.—E. Kawerau. Aug. 27, 1943. 580,429.

Process for manufacture of magnesium products.—E. P. Newton. (Marine Magnesium Products Corporation.) Nov. 12, 1943. 580,367.

Dyestuffs of the anthraquinone series.—Sandoz, Ltd. July 16, 1943. 580,351.

Dyestuffs of the anthraquinone series.—Sandoz, Ltd. July 16, 1943. 580,352.

Production of cellulose ethers.—J. H. Sharphouse, and J. Downing. Nov. 22, 1943. 580,359.

Olefin polymerisation process.—Shell Development Co. April 12, 1943. 580,310.

Process for the production of polymers and apparatus therefor.—Standard Oil Development Co. June 26, 1942. 580,407.

Treatment of a copper surface to prevent molten metal adhering thereto.—Standard Telephones & Cables, Ltd., E. Mills, and E. C. J. Marsh. April 21, 1944. 580,379.

Production of artificial insolubilised wet-spun protein filaments.—R. H. K. Thomson, D. Traill, and I.C.I., Ltd. Sept. 6, 1944. 580,434.

Production of insolubilised filaments, threads, films, or the like shaped products by the wet spinning of protein solutions.—W. A. Caldwell, J. Jack, and I.C.I., Ltd. Aug. 9, 1944. 580,508.

The Chemical Age

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1425. October 19, 1946 Annual Subscription 21s. Overseas 26s.

Technical Work and Teaching

THE circular issued by the Ministry of Education early this year (No. 94 of April 5) put the cat among the pigeons. In that circular it was suggested that: "Any scientist or technologist serving on the staff of a technical college who is competent to act as a consultant to industry should be encouraged to do so." The use of the word "consultant" in this connection immediately raised in the minds of those whose business is that of acting as consultants to industry the belief that the Ministry was asking technical college staffs to undertake their work. The consultants wanted a "closed shop," the Ministry wanted a free-for-all. Consultants rightly pointed out that they had to maintain staffs, offices, laboratories, and so forth, while all these things were provided for the staffs of technical colleges by money provided by the ratepayers or extracted from the public by the tax-gatherers. We have on occasion in the past referred to consulting as "a dying profession," and by so doing we earned the rebuke of those who are still very much alive. The profession has shown itself alive on this occasion also. Although many firms carrying large staffs do not on paper need consultants, it is found that certain work can be profitably handled by the temporary engagement of specialist consultants, and many of these firms also pay retaining fees to specialists on whose services they can call on demand. We have a great deal of sympathy with the feeling of consultants that there should be no official encouragement to those in other full-time employment to encroach on their preserves.

The controversy raises the important problem of the position of the staffs of technical colleges and universities in relation to industry. It is, of course, common knowledge that industrial concerns seeking the best man for a particular job not infrequently go to a professor. No one would wish to deny the services of the professor to industry. It is, however, not universally acknowledged that a professor is properly engaged when acting as consultant to a particular firm. His job is to teach and to engage in research. Consulting work is not research. Should not the professor, even the professor of some form of applied science, spend his time and energies in the advancement of knowledge generally, rather than by devoting his time to the service of the few? That question is asked and must be answered before there can be general acquiescence in the principle that a professor may engage in extensive consulting work.

On Other Pages

The professor and lecturer in technical subjects, subjects known collectively as "applied science," may be in a different category here from that of the staffs of pure science departments. It is highly necessary for those who teach industrial subjects to keep in touch with industrial practice. Much of the support given to the Ministry of Education's recommendation arises from this cause. Thus, Sir William Larke has pointed out that the association of science with industry inherent in the Ministry's proposal "has revolutionised scientific and technical training for industry," and he goes on to maintain—a fact which all can accept—that the increasing employment of men with degrees in industry, even in engineering, has been particularly brought about by "the background of the studies introduced by professors with a knowledge of industrial problems and requirements." It is elementary common sense that this industrial background must be retained. All will agree that the teacher of the application of science to industry is gravely handicapped if he does not know the background of the industry; contrariwise, he is considerably helped if he can relate what he is teaching to current practice. If, then, industry wants students trained to know in advance something of the industry into which they are to go, the teachers must be themselves experienced in that industry. If industry requires that students should be taught principles only, the position is totally different, and industrial experience is unnecessary.

The problem then arises: How can lecturers keep themselves in touch with industry? To our mind, the solution is that there should be an interchange of personnel between industrial firms and technical colleges. If the teacher could spend three to six months in industry every two or three years, he would be able to keep abreast of current industrial views and practice. It may be objected that in that time he will not be of much use to anyone, and that the firm may lose heavily on the exchange. We hardly think this argument is sound, always assuming that the position to be occupied by the temporary entrant was arranged with sufficient care in advance. Moreover, it is certain that the members of the staff carefully selected for their ability to "put over" their ideas, who were seconded to teaching work for the period would learn a great deal. There is nothing like teaching a subject to rub up one's knowledge of it! The principle of interchange between industry and universities and technical colleges is not new. It has been advocated frequently of late years. The increasingly technical nature of the work of technical staffs renders refresher courses of considerable importance, and we prophesy that there will be a demand for such courses in many subjects. Interchange of staff is one means of securing that brushing up of knowledge which is so greatly needed.

This still leaves untouched the major problem of the manner in which technical men at teaching institutions can fit into the framework of local industry. The Research Association of the Iron and Steel Industry appears to have hit on a happy solution. The technical colleges, in their view, are best fitted to carry out background research, that is research into the whys and wherefores of industrial practice. The elucidation of the factors that lie behind any industrial process is a most important matter, and one that leads in turn to further advances. Industry should make use of lecturers in technical teaching institutions to do research for which they are suited, and in particular research which is better done in a college than in a works laboratory. A report to the Institution of Electrical Engineers in 1944 said: "Technical colleges, especially regional technical colleges, should be encouraged and assisted to carry out a certain amount of engineering research and development in collaboration with local industry." That is not consulting work as we understand the term, and it is a direction in which the talent of lecturers at technical colleges can be put to first-rate use, besides giving subjects of real value at which student investigators may try their hands in the course of their training. The provision of subjects for research is a matter of considerable importance, and is one of the directions in which collaboration between industry and teaching institutions should be most valuable and fruitful.

The Soviet Union exported last year the following quantities of metals and minerals to the United States: manganese ore, 70,802 short tons; chromite (metal content), 77,124 tons; platinum, 66,748 oz.; palladium, 9966 oz.; iridium, 1027 oz.; apatite, 14,340 short tons; potassium muriate, 6681 short tons; asbestos, 2344 tons; magnesite, 4726 short tons; cut diamonds, 3569 carats; cut emeralds, 2689 carats.

NOTES AND COMMENTS

The Law and Process Secrecy

THE loyalty which a worker owes to his employer in law, may not extend very far outside working hours. But the worker with knowledge of a highly skilled process is in a special position. The wise employer binds him in his contract of service to treat his knowledge as confidential. Even in the absence of a special agreement, the law will preclude him from using outside his employment specialised knowledge which has come to him solely through his employment. But it will not interfere with him if he uses knowledge which he has acquired outside his work simply because he is a clever fellow. The Court of Appeal had to consider an interesting case recently. Two employees, who were engaged on a secret process, went to work for a rival firm in their spare time. They did not tell their employer, who sued for an injunction to restrain the rival firm from employing these men in their spare time. Mr. Justice Cohen refused it, saying that there was no term in their contract with regard to the use of their spare time and there was no proof that they had communicated knowledge of a secret process which they had acquired in the course of their work. On appeal, however, this decision was overruled and an injunction was granted, the Court holding that it would be impossible for these people when working in their spare time to keep their secret knowledge locked up in a separate compartment in their minds. It was clear that they must have used it, although no definite proof could be produced, and therefore the Court would prevent them from being employed in this spare-time work.

Atomic Energy Bill

LAST week the House of Commons passed a bill—the Atomic Energy Bill—which gives power to representatives of the Ministry of Supply to enter and search premises without a magistrate's warrant. This same bill puts a gag on the discussion or dissemination of information about atomic energy and its plant, while the interpretation placed on "atomic energy" and "plant" is so wide that virtually all scientific discussion could be stopped at the will of the Minister. Although no vote was taken on the Bill, it would seem from the comments of speakers and letters to newspapers that there is a substantial body of opinion both inside and outside the House which is perturbed by the almost completely prohibitive and negative character of the Bill. The clause which caused most disquiet was clause 11—the secrecy clause—perhaps to be known in the future, as one Commons speaker remarked, as "the infamous clause 11." Under this clause it is made an offence to communicate knowingly, without the consent of the Minister, any information on equipment, devices, or processes used or proposed to be used for the release of atomic energy (including the small-scale production of radio-active elements). It was claimed by opponents of this clause that since workers in Government establishments are already sworn to secrecy by the Official Secrets Act, this clause will apply only to workers in the universities or industrial laboratories. As a wide interpretation is given both to atomic energy and to plant in section 18, it was stated that clause 11 would tend to prevent free discussion between collaborators in fields of research bordering on the subject of atomic energy, including physics, engineering and chemistry. Workers in these fields could not possibly foresee if their particular research or equipment might not in the future have some bearing on atomic energy and they would be extremely chary of discussing or publishing anything about their work.

Development Obstructed

THIS stifling of information would lead to people working in small watertight compartments, which inevitably would obstruct the full and quick development and utilisation of atomic energy. There would be doubt and timidity even between colleagues working on the same problem. It is true that the Minister could grant exemption from clause 11 in certain cases, but it is also true to say that he would probably err on the side of safety rather than allow greater freedom for scientists. It was pointed out that the Government itself may suffer from this secrecy, because work in private laboratories may be kept so quiet that even the Government may not hear of it. (When it does, it has power to demand a written report on all the work being done at that laboratory bearing on atomic energy.) A further criticism of

the Bill is that there is no provision for an advisory committee of scientists, such as the Americans and Australians have, for studying the day-to-day problems connected with the development of atomic energy. It is true the Anderson Committee is still in being, but this committee is studying atomic energy from the wider aspect, and apparently is not concerned with day-to-day problems arising from its development. The Minister defended this omission on the ground that such a committee would tend to be a barrier between himself and Parliament.

Reason for Delay

THE Bill, which first came before the House of Commons in May, received its second and third readings only last week. The reason for this long delay was explained by the Government as due to their desire that opinion outside the House should have time to crystallise and reactions be passed on to them. The Government claimed that the reactions of many people and organisations were received. But as the Bill in its final form differs little from that originally proposed, it would seem that either the reactions were favourable, or, if unfavourable, they were ignored by the Government. The first hypothesis is untenable, since some aspects of the Bill were criticised by more than half the speakers in the debate, while further criticism came from associations of scientists outside the House. It would thus seem that expert opinion unfavourable to the Bill has been ignored by the Government.

The German Technicians Reappear

"MORE than twenty" German scientists and technicians are now working in Great Britain, it is reported, each of them being in possession of the secret of some process or method which is unknown in this country—that being a condition of their employment. These secrets, it is understood, they are in process of disclosing to British firms. In addition to having these special scientific qualifications, they are also guaranteed politically pure, having been "vetted" to ensure that their politics are "unobjectionable." The Board of Trade has stated that these men are in the employ of the British Government, in the first instance on six months' probation, after which period they will be allowed to bring in their wives and young children. Employment of British scientists, it is stated, will not be affected; and the German scientists will receive pay commensurate with their status. We should like to know: (a) who pays them; (b) who gets the ultimate concrete benefit of their work: (c) what "more than twenty"—a magnificent example of Board of Trade ambiguity—really signifies and (d) whether these are the same technicians who disappeared suddenly in the direction of Barrow-in-Furness last year?

Salmon by KCN Process

FISHERMEN who "play" a fish for hours before landing it must have been filled with indignation and dismay on learning last week of the methods now being used by modern poachers. It seems that two salmon poachers, not to be outdone in the general scurry to seek the assistance of science in order to improve production, have resorted to the use of potassium cyanide to overcome the wiles of the fish. A gamekeeper found the men by the side of a river pool into which they had put the potassium cyanide to poison the salmon. The pool was full of fish, which were leaping out of the water and gasping for breath. One of the men was endeavouring to gaff the salmon, while the other was trying to catch them with his bare hands. Now sporting fishermen may enlist the help of science to camouflage their bait so that it looks as good as nature's—or even better. They recognise, albeit with reluctance, that to "tickle" a trout to disaster is a work of piscatorial art. But for anyone just to saunter to a pool and with no other preliminaries throw in potassium cyanide and then—shades of Izaak Walton—try to catch the dying fish with his hands . . . ! That the men should have to appear in court to answer for it is the very least that any ardent wielder of rod and line would demand for this sacrilege.

BARYTES PRODUCERS

At its recent annual general meeting, the British Barytes Producers' Association elected the following officers: *Chairman,* Mr. I. D. Orr (Arran Barytes Co., Ltd., and James Miller Son & Co., Ltd.); *vice-chairman,* Col. J. V. Ramsden, C.M.G., D.S.O. (Devonshire Baryta Co., Ltd.); *treasurer and hon. consultant,* Mr. Alexander Reid; *hon. auditor,* Mr. S. Key (Hopton Mining Co., Ltd.); *secretary,* Mr. R. Murdin Drake, 166 Piccadilly, London, W.1.

Association of British Chemical Manufacturers

The chairman, Mr. L. P. O'Brien, at the annual dinner

Export Achievements

THE 30th annual meeting of the Association of British Chemical Manufacturers was held in London on October 10, with Mr. L. P. O'Brien in the chair.

In moving the adoption of the annual report, the chairman alluded to the Association's loss by the death of Dr. E. F. Armstrong, one of its signatory members and later hon. treasurer, vice-chairman, and chairman of council. Mr. O'Brien referred to the steady growth in membership of the Association. He spoke of the vast number of varied and complex problems, important to the chemical industry, which had come under consideration by the Council. Referring with pride to the trebling of British exports of chemicals, drugs, dyes and colours as compared with 1938, the chairman remarked that the industry would have done even better, but for the great difficulties they were encountering with regard to personnel, buildings, plant, and equipment for replacement and extension programmes.

Shortage of Chemists

"I fear," said Mr. O'Brien, "that for several years there is the prospect of shortage of recruits to our scientific and technical staffs, such as chemists, engineers, chemical engineers, and draughtsmen. In this connection, we have been glad to note that both the immediate and the long-term problems of education and specialised training are receiving attention in appropriate quarters. The future position of British chemical industries will largely depend on the quality of, and the education and training given to, new entrants. We had ample proof during the recent struggle for existence how much Britain owes for its survival to British chemical manufacturers, who not only met every call that was made upon them for chemical products, but also lent skilled staff of all types and grades to help service the Government departments.

"As regards plant, we had hoped that equipment obtained as reparations from Germany would have become available to assist us early this year and some of us had counted on this, knowing the herculean task confronting our friends, the British chemical plant manufacturers, in trying to meet in a reasonable time home and export demands for their productions. We are very disappointed with the slow progress that is being made with reparations in spite of the help we willingly gave to the Government at the end of last year, by sending out teams of experts to earmark equipment suitable for chemical manufacturers. No deliveries of chemical plant from Germany now appear likely for some months to come. It is also understood that the quantity ultimately to be made available will be far less than we had expected, and we fear that a great deal of the small amount we are likely to have allotted to us will not be in very serviceable condition after the long period it has stood idle. This makes it all the more important that the British chemical manufacturers should be allowed first claim on chemical plant and equipment made in this country, until the urgent needs of the industry have been met.

"As far as our own products are concerned, we are told by the Government that the requirements of other British industries come first, so that they may not suffer any hindrance in their export programmes by shortage of the necessary chemicals which are essential to them, and then, after that, we can export any surplus. This is the policy to which we operate. It seems logical that a similar policy should hold as regards supplies to our own requirements of plant and equipment. It is surely in the long-period national interest that we should have at the earliest possible date adequate plant to enable us to maintain and increase output and thus establish ourselves firmly in overseas markets which are now clamouring for chemicals, rather than that we should export any chemical plant until home demands are satisfied.

"The export programme visualised as necessary by the Government to enable us to balance our imports postulates an overall increase of 75 per cent. by volume as compared with 1938. Allowing for the rise in prices since then, the chemical industry is well on the way to achieving this target in its own field. However, many people

wonder whether it will in fact be possible, with the manpower likely to be available to exporting industries, to produce the requisite volume of output. In the circumstances, we must concentrate more than ever on improving our methods of manufacture and the design of our plants, with the object of obtaining more and better quality products for the same or less man hours than formerly. Unfortunately, there are many cases where manual effort is not expended to the not unreasonable standards achieved in pre-war years The restoration and maintenance of reasonable standards of output per man hour is essential. The united efforts of employers and employed should be directed towards increased production per man hour and, of course, if the total hours worked per week are reduced, the greater must be the relative rate of increase per production hour.

German Technical Reports

"As to Germany, every effort has been made by the Association to accelerate the despatch of investigating teams to study German chemical production and the publication of the subsequent reports. Delays there have been, but few of them can be attributed to our industry. The machine is now working well and shortly we shall have excellent technical reports on all aspects of German chemical manufacture.

"Before VE-Day, the Association submitted to the Government a carefully considered memorandum on the post-war treatment of the German chemical industry, and when the Control Commission was constituted, the A.B.C.M. set up at its request an advisory panel to assist it in its difficult task. This panel has never once been consulted, and one can only guess at what happened to the memorandum. Experience of the last two wars has proved that Germany's chemical industry was her greatest asset in her peace-time economy and in her war potential. This was derived not so much from the plant and equipment which the industry possessed and which could be turned to many war-time uses, as from the large army of skilled scientific and technical staff which the industry supported and which enabled Germany to develop domestic sources of supply for materials previously obtainable only from outside sources and to invent and manufacture new types of munitions of war. It was hoped that, in the interests of future world peace, the German chemical industry and its technical staff would be vigorously curtailed. Unfortunately, this vital necessity was apparently not appreciated by the Quadripartite Commission which settled the level of German industry. As a result, we see that Germany is being allowed to retain the bulk of her chemical capacity. She has not been limited to her domestic needs but has been permitted substantial exports in the important fields of dyestuffs and pharmaceuticals. We see again the possibility of the re-establishment of the dangerous organisation which gained so much power in the world in the years before 1939.

"Since the announcement of the levels to be allowed to German industry, pressure has been brought to bear on the Government to provide means for full consultation with industry regarding the difficult problems of controlling German production and exports in accordance with the Control Commission's broad policy. We are now advised that means of consultation will be provided through the Government Department responsible for the different British industries, and as a beginning we are expecting that a small mission, consisting of dyemakers and colour users, will shortly proceed to Germany to discuss problems relating to the dyestuffs industry in the British zone. It is hoped that similar arrangements will be made in regard to other sections of the chemical industry and that the basis can be broadened to allow of these problems being dealt with over such part of Germany as comes within the single economic unit visualised by the Americans and ourselves. In this way it may be possible to secure adjustments in the German plan, which will safeguard allied interests and the future peace of the world, while still enabling Germany to attain an import-export balance."

Points from the Report

The annual report stated that the Association joined with other trade associations, through the F.B.I., in urging on the Government that British industry should be consulted in the detailed working out of the plan for the control of German production and distribution and in connection with plant for reparations.

A special joint deputation with the Colour Users' Association had previously met the Parliamentary Secretary to the Board of Trade on the policy recommended for the control of the German dyestuffs industry as a war potential, on the broad basis outlined in the last report, but the decisions of the Quadripartite Commission showed that the proposals were not adopted. Instead, the German dyestuffs industry was to be allowed to reach by 1949-50 a production of 20,000 tons of dyestuffs for home use and no limit on the total value, and to export dyes to the value of RM. 58 million, with a possible restriction to 11,000 tons to make up this amount. Similarly, the German pharmaceutical industry was to be allowed to operate at 80 per cent. of its 1936 level and to export to the value of RM. 120 million. Apart from certain heavy chemicals where the level was fixed at 40 per cent., the rest of the German chemical

industry would be allowed a level of 70 per cent. of the 1936 basis.

A scheme agreed with the Colour Users whereby British dye makers undertook the distribution of certain stocks of German dyestuffs to be purchased for use in this country had been accepted by the Board of Trade.

Experts for Germany

At the urgent request of the Government, the Association organised eight teams of technical experts to visit Germany to earmark plant to be available for reparations. Detailed reports and particulars were supplied to the Board of Trade, but the latest indications were that the plant likely to be declared available would be so small in quantity and so late in arrival that it will contribute little towards the re-habilitation or expansion of British production. The Association was instrumental, by means of a special appeal to members, in finding a considerable number of men for technical posts in the chemical division of the Allied Control Commission.

The Association provided a technical man to act as liaison officer on the staff of the Board of Trade to deal with inquiries to the Control Commission in Germany in connection with the chemical, plastics and rubber industries. A technical man was also supplied to enable the Board of Trade to prepare a detailed index of the mass of reports on the German chemical industry, with the ultimate objective that this index should be published and so made generally available. Information was collected and forwarded to the Board of Trade as to German technicians required by members for employment or interrogation in this country, and members have been advised when technicians of interest became available for interrogation here. The Association supplied special teams of exports on a rota basis over a period of several weeks, to scrutinise captured German documents, and to advise on those likely to be of interest to the chemical industry. Copies of summaries of these documents were made available to members and arrangements were made for micro-film copies of the originals to be obtainable.

The Association was afforded the opportunity of suggesting targets for investigation in the Japanese chemical industry. It was understood that reports of investigations made by American teams would be available equally in both countries as in the case of the reports on German works.

Paper Control difficulties, printing delays and staff shortage had successively delayed the publication of the Association's first post-war directory. Though the directory will for the first time be printed only in English (with separate editions in other languages if and when that was necessary and possible), the coming edition should prove worthy of the occasion, as it would combine the scope of "British Chemicals" and the "Directory of British Fine Chemicals," as previously issued, and so cover all chemicals made and offered for sale in this country.

By means of monthly written or verbal reports from its representatives, the Council has kept in closer contact than hitherto with the work of the Chemical Council which, however, continued to deal only with matters of indirect concern to the chemical industry. It had, therefore, been found unnecessary for the Council to do more than note these reports of the activities of this body. The Association's representation on the Chemical Council had been varied in the course of the year, arising from retirements in accordance with the Chemical Council's constitution and by resignations; the Association's present representatives were: Mr. R. Duncalfe, Dr. G. Malcolm Dyson, Sir Harry Jephcott, Mr. J. Davidson Pratt.

The competitive claims of export and home orders for chemical plant were discussed with the British Chemical Plant Manufacturers' Association, and the best means of collecting information as to requirements on which definite plans by the plant makers could be based was being examined.

Supply of Chemists

Following the approach to the Ministry of Labour mentioned in the last report, that Ministry, in conjunction with the Ministry of Education, made arrangements for a special post-graduate course in chemical engineering, and the Association was invited, together with the Institution of Chemical Engineers, the British Chemical Plant Manufacturers' Association, and the Institute of Petroleum, to form a joint panel with the Ministry to select chemistry, physics or engineering graduates to take the courses. Hope was expressed that members in the industries concerned would take the men chosen into their works if time permitted, for preliminary training prior to the course, and later employ them when their course was completed.

After a hiatus caused by the General Election, the present Government implemented the Report of the Industrial Alcohol Committee of the Treasury, by withdrawing the allowance on industrial alcohol as from January 1, 1946. Efforts by the Association to get statutory provision for machinery for dealing with hardship cases failed, the Government attitude being that the nature of any necessary machinery could only be determined when the nature of any cases calling for its operation was known. Although this was an unusual attitude in such circumstances, the

Council recognised that the prospect of hardship cases arising was uncertain and that it must wait for such cases before pressing the matter further.

The "iron ration" award of supplementary clothing coupons for heavy chemical workers was continued during the year. The Association had continued to administer a pool of coupons for clothing destroyed by accidents arising during chemical manufacture.

By a clause in the Finance Bill covering the last Budget, the Key Industry Duties which were due to expire in August, 1946, would be retained for a further two years. The industry was working under a serious disadvantage by the absence of import statistics for key industry chemicals. H.M Customs and Excise had none of the prewar expert staff which compiled the returns, but it was hoped that the position would improve in time for resumption of the returns from the beginning of 1947.

Patent Law

The Joint Chemical Committee on Patents completed and submitted Part II of its Memorandum of Evidence on Patent Law Reform to the Board of Trade Patents Committee, 1944. This Memorandum amplifies certain of the recommendations made in Part I and supplements them by proposals covering the whole field of patent law. The Second Interim Report of the 1944 Committee (Cmd. 6789) incorporated many of the proposals put forward by the Joint Committee. Parts I and II had been printed in a single volume, containing an index and a summary of recommendations, and placed on sale. An article by the chairman of the Joint Chemical Committee on a proposed new criterion of subject matter on patent applications was published in *The Times* and gave rise to a valuable discussion.

The proposal by Group B that the Association should have a public relations officer who would bring prestige publicity to bear on the chemical industry was accepted in principle by Council, but on reference to other groups met with a mixed reception. On a report prepared at Council's request and dealing with the whole subject of publicity, it was decided in November, 1945, not to appoint such an officer but to reconsider later.

A joint committee has been formed with the Association of Chemical and Allied Employers to secure united representation of the chemical industry in matters of major policy of common interest. One of its first tasks was to take up the question of labour shortage, and in this connection the two Associations were conducting a preliminary survey of the working conditions, including safety, in the industry.

In the past the Association nominated representatives to certain local employment committees of the Ministry of Labour; the Council decided that this matter fell more within the sphere of the Association of Chemical and Allied Employers and had suggested that that Association take over the nominations.

Tar Distillation Products

It was not considered appropriate or practicable to give in the report a full review of all the activities of Group C, which, working in conjunction with the Association of Tar Distillers as hitherto, covered the tar distillation industry. Reference was, therefore, confined to some of the items which would also be of significant interest to other sections of the Association.

The recommendations of the Hydrocarbon Oil Duties Committee, to which statutory effect was given in the Finance (No. 2) Act, 1945, envisaged a system of assistance to chemical consumers of hydrocarbon oils without prejudicing the protection afforded by the duties to the producers of indigenous oils. The tar distillers' representations to the Committee were in this wholly successful.

In respect of a number of tar products used by the chemical and other industries, the industry suffered under the disadvantage of being controlled on home-selling prices and restricted in, or prohibited from, exporting its products. In several cases, the consumers were not so controlled and could take advantage of the export demand at attractive prices. While appreciative of the importance of exports in the most highly manufactured form possible in order that the maximum of foreign exchange can accrue, tar distillers held the view that they were entitled to a share in the benefits accruing from exports to which they made a vital contribution. The exporters of manufactures based on tar products were for the most part sympathetic, as also was the Coal Tar Control, but there were difficulties in finding a solution acceptable to the Government. Discussions were, however, still continuing.

Technical Education

The Council received a memorandum from the Education Committee of the Society of Chemical Industry containing proposals for technical training and education of junior technical staff, and suggesting that the City and Guilds Department of Technology, in conjunction with the industry, should be the body responsible for drawing up the syllabuses of instruction and conducting examinations in chemical technology. The Joint Committee with the A.C. & A.E. recommended that the two associations should each nominate a representative to the Education Committee of

the S.C.I. to consider these proposals, and that had been done.

The Council was also approached by the Education Committee of the F.B.I. in connection with the proposals for specialised training in those branches of technology where requirements were for only a relatively small number of highly qualified technical staff. It was suggested that one or two technical colleges might serve as centres for the whole country. The Ministry of Education was understood to be in favour of suggestions of that nature, provided they were fully supported by the industry concerned. The Council referred the matter to the Society of Chemical Industry for suggestions for suitable centres.

During the year a deputation from the Indian Chemical Manufacturers' Association visited this country under the leadership of the chairman, Dr. Hamied. Council officially welcomed the delegation at a luncheon for the purpose and the staff assisted the delegation with information and introductions to members of the Association whom one or other of the delegation specially wished to meet.

Export Problems

Following an informal meeting convened by the F.B.I., the Association collected from members information as to obstacles in the way of export trade. These were summarised and forwarded to the Board of Trade through the F.B.I. The replies indicated that labour, raw materials, shipping, Government regulations, licensing and controls, machinery and packing materials, were the main obstacles. The Association was collecting from members their detailed views on international trade in preparation for the International Trade Conferences proposed by the United States and the agenda for which was set out in the White Paper (Cmd. 6709) issued in connection with the American loan. It was hoped to present, in co-operation with the affiliated associations, a co-ordinated statement on behalf of the chemical industry as a whole, covering the general policy as well as the specific questions asked by the Board of Trade regarding imperial preference foreign import duties and restrictions and import duties into this country.

Following the recommendation of the Joint Committee with the A.C. & A.E., the Works Technical Committee was dissolved and a new Works Safety Committee was appointed with the following terms of reference: "To make a preliminary survey of the safety and health problems in the chemical industry and to submit recommendations as to action." The Committee had surveyed the whole field of technical safety in the chemical industry, and is submitting a series of recommendations to Council for consideration by the Joint Committee, including the revision and completion of the Model Safety Rules for use in chemical works, codes of good practice, instruction of technical personnel through the universities and professional qualifying bodies, propaganda and advisory services. In particular, the Committee had urged the setting up of a national body to undertake the testing of chemical compounds for toxic or dangerous properties and to make available to industry the published information on the subject.

Some years before the war, the Committee on Industrial Solvents, under the Medical Research Council, made a start on the collection and publication of reliable information on chemical products used industrially as solvents. Provision was being made for physiological tests where information was conflicting or wanting, when the war put a stop to the work. Shortly after VE-Day, an opportunity arose to continue certain wartime facilities for such toxicity tests and the Association approached the Ministry of Supply, stressing the importance to the chemical industry of such facilities and the necessity for manufacturers to have accurate and authoritative information to enable them to take proper precautions in manufacture and use. No response, however, had been received.

The Council endorsed an official letter from the Chief Inspector of Factories to all firms throughout the country with chemical laboratories, urging that more attention should be paid to safety precautions in laboratories, especially in connection with research laboratories (which were not subject to the Factories Act).

Council for the Year

President: Mr. C. F. Merriam; vice-presidents: Dr. F. H. Carr, C.B.E., Mr. R. Duncalfe, Dr. E. V. Evans, O.B.E., Mr. C. A. Hill, B.Sc., Dr. P. C. C. Isherwood, O.B.E., Mr. R. G. Perry, C.B.E.

Elected members: Chairman: Mr. L. P. O'Brien; vice-chairman: Sir. F. W. Bain, M.C.; hon. treasurer: Mr. C. E. Carey.

Mr. T. R. G. Bennett, Mr. A. D. Daysh, Dr. A. E. Everest, Mr. C. G. Hayman, Mr. G. E. Howard, Mr. W. M. Inman, Sir Harry Jephcott, Mr. W. F. Lutyens, Mr. T. D. Morson, Mr. D. J. W. Orr, Mr. F. G. Pentecost, Mr. K. H. Wilson, Mr. H. Yeoman.

Co-opted members: Mr. F. C. O. Shaw, Mr. D. Spence, Lord Trent, Mr. S. W. Whiffen.

Honorary vice-presidents: Mr. N. N. Holden, Lord McGowan; director and secretary: Mr. J. D. Pratt, C.B.E., M.A., B.Sc., M.I.Chem.E., F.R.I.C.; joint managers: Mr. R. M. Drake, O.B.E., M.Sc., and Mr. A. J. Holden, B.Sc., F.R.I.C.

A.B.C.M.'s First Post-War Dinner

Sir S. Cripps on Future German Rivalry

More than 300 representatives and friends of the British chemical industry attended the annual dinner of the Association of British Chemical Manufacturers at Grosvenor House, London, on October 9. This was the first dinner held by the Association since before the war. Mr. L. P. O'Brien, chairman of the A.B.C.M., welcomed the members and guests, among them men prominent in Government circles, the Civil Service, the Universities, learned societies and industry. The principal guests were the Rt. Hon. Sir Stafford Cripps, K.C., M.P., President of the Board of Trade; Sir Robert Robinson, President of the Royal Society; and Sir Clive Baillieu, President of the Federation of British Industries.

Sir Frederick Bain, vice-chairman of A.B.C.M., proposed the toast of "The Guests," and referred with pleasure to the presence of Sir Robert Robinson, whom he called "the greatest living organic chemist." Among their guests were men representing the Board of Trade, Ministries of Supply, Health, and Labour, the Home Office, D.S.I.R., UNRRA, the Government Laboratory, India Office and H.M. Customs and Excise. Sir Frederick congratulated Sir Stafford Cripps on his obvious recovery of health and remarked that he was ominously full of strength and vigour. Sir Stafford had made this country export-conscious as she had never been before and the chemical industry had to acknowledge the great things he had done as President of the Board of Trade.

Minister Compliments Industry

Sir Stafford Cripps, replying, said: "My association with your industry has been a long one, since the days I spent under Sir William Ramsay in the laboratories of University College, London, so I do not feel myself to be a stranger to your activities. As this is your first post-war gathering, and as I saw a great deal of the activities of your members during the war, I should like to take this opportunity of complimenting you upon the great contribution which you made to the war effort. Fortunately, during the first Great War we learned how deficient we were in our chemical industry, and had done a great deal to repair the deficiency before the second World War struck us. We learnt that in every phase of war-time production chemicals of one sort or another are required; whether it is raw materials for other industries or as finished products for a multitude of uses, there are few phases of production and consumption in which chemicals play no part at all.

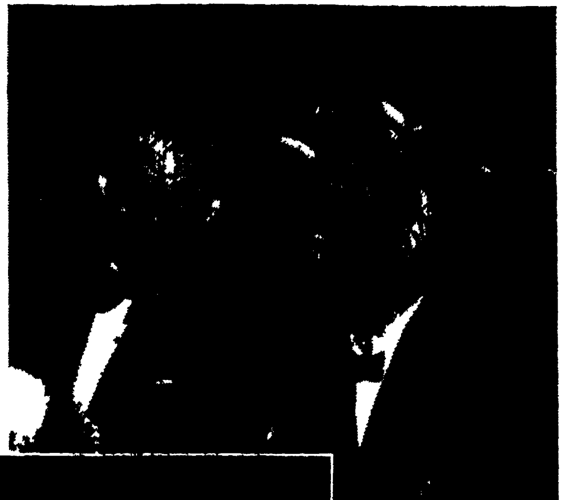
"Now the war is over and our minds are turned back to peace-time production, we are looking to the chemical industry to help the nation, particularly in the field of exports. The chemical industry has been an expanding industry, and our chemical engineers, who equal, if they do not surpass, those of any other country in the world, have done a great deal to build up the efficiency of chemical output. It is interesting to observe that the increase of output per man employed in the chemical industry has exceeded that in other industries generally over the whole inter-war period. This is, of course, partly due to the nature of the industry, and the size of the batches of material that can be treated in the various processes, but it is nevertheless a most important factor when we regard the over-all shortage of labour that exists in this country to-day. The less labour we expend upon every ton of product the more we shall be able to produce, for, except in certain special areas of the country, labour is the bottleneck in production to-day.

Future Foreign Competition

"There is another aspect of this same problem. We have lost—temporarily at least—one of our strongest competitors in the international field, Germany. In addition to that, the result of the war has been to give us a seller's market all over the world. That makes selling easy at almost any price and of almost any quality. But that condition of affairs is not going to last for ever—indeed, it may last a much shorter time than a good many people seem to anticipate at the present. During that period of a seller's market we have the opportunity to prepare for the more difficult days of a buyer's market that will follow. Then we shall have to depend upon our competitive efficiency in order to make the overseas sales we need. Nor can we imagine that Germany is going to be permanently out of the market. We cannot afford to maintain the Germans out of our earnings; they must earn their own living, but to do so they will have to export many commodities, and among them I have no doubt will be chemicals. We have the chance now to get into those markets out of which German competition kept us in the past, but we shall only be able to win and retain them if we can reach a high degree of efficiency which will enable us to sell at competitive prices and competitive quality.

"At the moment, exports of chemicals,

AT THE DINNER



Below : from left to right :

Dr. G. Roche Lynch, President of the Royal Institute of Chemistry.

Dr. C. H. Clarke, Technical Director of Lever Bros.

Professor E. K. Rideal, Chairman Chemical Council and President S.C.I.

Above:

Professor R. G. W. Norrish, President B.A.C.

Mr. R. R. Bennett Director of British Drug Houses.

Right:

Sir Robert Robinson, President of the Royal Society.

Sir Edward Mellanby, Secretary of the Medical Research Council.

Professor Sir John Lennard-Jones, a General Secretary of the Royal Society.

Left: Sir Stafford Cripps and Sir Clive Baillieu in jovial mood.

The chairman, Mr. L. P. O'Brien greeting Sir Robert Robinson.

drugs, dyes and colours, which is the heading under which the exports are listed, are not going too badly. This year so far we have averaged nearly £5,500,000 a month compared with about £1,800,000 in 1938; that is probably an increase of rather more than 60 per cent. by volume. It is a good beginning, but we must go much further for we look to this industry as the one that can give us more than the average 75 per cent. increase by volume that we need. There is a great task before the chemical industry, one which I am confident the chemical industry will be able to handle as in the past. While I offer you my congratulations upon your past achievements, at the same time I urge you on to the conquest of still wider fields and in that work I hope good luck and prosperity may accompany the workers of all grades throughout your industry."

Sir Robert Robinson, proposed the toast of "The Association." He appealed that more accurate information should be given in the filing of patents. No claim should be accepted unless experiments had actually been performed and described in detail. A new chemistry was arising, especially in the fields of high pressure reactions and catalysts. He wanted to lecture on these subjects, he said, but he could not find out what was being done.

The chairman, replying to the toast, agreed with Sir Robert Robinson about patents. With regard to the association itself, he said, it was in very good health and had a membership of 192. Speaking to the young new entrants to the industry, he told them they will not get an easy time in the chemical industry, which was a remorseless mistress.

Those present included: Sir Clive Baillieu, Sir Frederick Bain, Professor G. M. Bennett, Mr. R. R. Bennett, Mr. R. W. Beswick, Dr. F. H. Carr, Mr. M. B. Donald, Sir Jack Drummond, Mr. R. Duncalfe, Dr. E. V. Evans, Sir Harry Jephcott, Sir Norman Kipping, Dr. L. H. Lampitt, Mr. H. N. Linstead, M.P., Professor R. P. Linstead, Mr. W. F. Lutyens, Dr. E. R. A. Merewether, Mr. C. F. Merriam, Mr. D. J. W. Orr, Sir Ian Orr, Sir William Palmer, Mr. N. Garrod Thomas, Dr. H. E. Watts.

Mr. J. W. Belcher, M.P., Sir William Cooper, Dr. E. de B. Diamond, Dr. H. J. T. Ellingham, Mr. P. Good, Mr. N. Neville, Mr. W. E. O. Walker-Leigh, Mr. S. W. Whiffen, Mr. H. Yeoman.

SAFETY FIRST

Dust from Magnesium Alloys

Collecting Device Aids Safety

It is generally known that dust concentrations from machining operations on magnesium alloys present a serious hazard. Such dusts are explosive and highly inflammable under certain conditions. Many jet-propelled aircraft engine parts were made of magnesium alloys at the end of the war and great care had to be taken regarding dust disposal.

At the Rolls Royce factory at which the accompanying photographs were taken, the patent "Multiswirl" unit dust collector, manufactured by Dallow, Lambert & Co., Ltd., was used exclusively. Each flexible shaft-grinding machine or buffing machine had its own separate collection unit, in compliance with the requirements of the Factories Act. The components either rest on, or are carried in jigs fixed over a bench formed of tubular rods covered with polyvinyl chloride. These rods are spaced some ⅜ in. apart, so that heavy dust can drop right through, to be immediately immersed in the water bath underneath.

The light floating dust, which is particularly dangerous, is collected by means of a special tubular telescopic universal fitting with self-sustaining ball joint, under a keen suction. The dust thus collected is immediately and thoroughly immersed and scrubbed in a water chamber at the back of the unit, the special design of the duct causing the dust to pass through three water submersions. Cleaned air only is handled by the fan generating the suction whence a vent pipe is taken to atmosphere.

Fig. 1. The telescopic suction ducts are here shown extended down to bench-working level.

Should the velocity of air flow in the extract duct fall for any reason below the requisite speed for efficient collection, an automatic device stops the grinding or polishing machine. The machine cannot be restarted until the air flow is restored. Similarly, should the water level fall, on account of evaporation or any other reason, below the set level for efficient scrubbing of the dust, the same effect on the grinding machine is obtained.

Fig. 2. The dust collector adjusted to work carried on jigs. Note the tubular construction of the bench top.

In further compliance with safety requirements a time-lag switch ensures that the unit fan must run for a period of five minutes to clear out any latent gases which may have accumulated overnight, say, before the grinding machine can be started up. Should, however, the operator inadvertently cause a partial block in the air inlet at the hood, the five-minute delay is automatically cut out and the extractor having stopped can be started again immediately. The electrical control devices, in short, ensure that the operator cannot work his machine unless the dust-collecting equipment is working in an absolutely efficient manner.

An adaptation of this type of equipment is working very well on collection of dust from parting off rubber hose impregnated with steel wire, where there is a particularly serious fire hazard.

World Tin Position

Excess of Supply Unlikely

REFERENCE was made in The Chemical Age last week (see p. 450) to the opening of the international tin conference in London. The conference, which ended on October 11, was under the chairmanship of Mr. G. Archer, of the Ministry of Supply, who was head of the U.K. delegation, and besides others from the U.K. there were delegates from the governments of Belgium, Bolivia, China, France, the Netherlands, Siam, and the U.S.A.

The conference has reviewed the present and—in particular—the future world tin position from the angles of both supply and demand. The world mine production of tin for 1946 is estimated at 94.000 tons, against a consumption of 137,000 tons. The conference reached the general conclusion that—after allowances have been made for the uncertainties of the future—there is not likely to be an excess supply of tin during the next two years.

Resolutions of Conference

The resolutions as agreed by the conference are as follow:

(1) Having made a review of the prospective world supply-and-demand position of tin, the conference is agreed that a situation may arise at some future date in which potential production may be in excess of demand. In order that the position may be kept closely under review, the conference is agreed that in the interests of both producers and consumers continuous intergovernmental review of that position is required.

(2) The representatives of all the governments participating in this conference accordingly agree to recommend to their governments that an International Tin Study Group should be established as soon as possible.

(3) The conference recommends that during the period of shortage of supply the Combined Tin Committee in Washington should continue to make allocations of tin metal. There should be appropriate liaison between this committee and the proposed Tin Study Group.

(4) The conference recommends that discussions should be initiated between the principal interested countries to provide for the continuation of the Tin Research Institute.

(5) The conference agrees that the U.K. Government should be invited to obtain by January 1, 1947, from the governments which received invitations to the conference, their decisions regarding the establishment of a Tin Study Group and to arrange for a first meeting as soon as possible of the study group

German Match Monopoly

U.S. Proposes Liquidation

CONSIDERABLE interest has been caused in Sweden by a statement made by representatives of the United States Military Government of Germany that the United States has recommended the liquidation of the German match monopoly, 50 per cent. of the shares of which are owned by Sweden. After having made a careful examination of conditions obtaining in the German match industry, the office charged with anti-cartel measures has produced a detailed plan, which has been submitted to the three other Allied Governments in occupation of Germany. The main recommendations contained in this report may be summarised by saying that the German match monopoly company, which controls about 20 match factories distributed all over Germany, should be liquidated and the capital distributed to shareholders according to their holdings. All match companies should dispose of their holdings in other similar companies and the acquisition and holding of shares in other match companies should be prohibited. Furthermore, the Swedish-owned Deutsche Zündholzfabrik A.G. should sell, before December 31, three out of its four German plants under the condition that the same group may not buy more than one plant, while another company, the Süd-Deutsche Zündholz A.G., should similarly liquidate its plant before the end of the year.

It may be recalled that Sweden's participation in the German match industry—which still turns out about 11,000,000 matches per month—dates back to 1929, when Sweden granted a loan to the German Government. The Svenska Taendsticks A/B, Jönköping, holds about $50,000,000 of the 4 per cent. Kreuger loan, while holdings in German match companies total nominally about 37.000,000 Marks. Because no joint Allied statement has as yet been issued on this subject, no official comment has been made in Sweden, but it has been stressed there that the proposed liquidation could not be made compatible with the principles of international law.

According to an American chemical journal, the Germans developed an apparatus for the instantaneous testing of air for carbon monoxide. It utilises self-sealing tubes of silica gel through which air is pumped. One layer of the gel is impregnated with concentrated sulphuric acid. The other layer, impregnated with oleum and iodine pentoxide, changes to greenish violet in the presence of carbon monoxide. The tester, a compact unit, has nine detector tubes and a metal pump with which the sample of air is brought into contact with the test gel.

Welding Research in America

Rapid and Co-ordinated Development

FOLLOWING the president's address at the annual meeting of the Institute of Welding (see THE CHEMICAL AGE, Oct. 12, p. 449), an address was presented by Mr. Weigel, director of the Welding Research Council of the U.S.A. Mr. Weigel began with a brief description of the part that welding had played in the American war effort, and continued with an account of the work of the Welding Research Council of the Engineering Foundation, carried on in conjunction with the American Welding Society.

Undoubtedly, he said, the greater portion of welding research work carried on in the United States is done under the auspices of private corporations and essentially for their own benefit. Nevertheless, most of the progressive companies in the U.S. have learned from long experience that as soon as a particular piece of research reaches a state of perfection or completion it is a paying proposition to divulge the information fully in the form of technical papers presented by the individual research workers before appropriate engineering and scientific societies. In this way, the investigators and the companies derive full credit for this work. Part of such researches may lead to the development of patents, and, of course, the companies protect themselves by the necessary patent applications before the information is made public.

Dissemination of Information

For the most part, however, this research work is made to improve materials, methods of fabrication, and end products, or overcome difficulties, and to achieve lower costs. The Welding Research Council and the American Welding Society, through its standardisation and other activities, have encouraged the prompt dissemination of this information. As a matter of fact, in many instances some of these researches are undertaken as part of committee assignments on the part of the paid staff of these companies. Undoubtedly British companies have also recognised the desirability of divulging such information when sufficiently completed so as to be a credit to the company.

During the war, various governmental agencies, through the War Metallurgy Committee, conducted research on many phases of welding which probably amounted to several million dollars. For the most part, these activities centred in the solution of immediate war problems. A number of the investigations were concerned with the development of special electrodes for the saving of strategic materials. With the cessation of hostilities, most of the governmental research in the welding field came to an end, a notable exception being the work relating to ship construction.

The welding industry is deeply indebted to the various governmental agencies for the research work conducted in the welding field. In a number of instances these agencies have taken projects initiated by the Welding Research Council and advanced them on a large and rapid scale. They have also initiated a number of fundamental research projects which, if successfully completed, either by these agencies or by the Council, will be of considerable benefit.

Co-operative Research

Co-operative research in the welding field in the U.S. before the war was largely conducted under the auspices of the Welding Research Council. The Council, in effect, is a committee of research-minded executives appointed by the Engineering Foundation for the purpose of stimulating and conducting research in the welding field, the dissemination of welding research information, and co-operation with similar bodies in foreign countries. The Council is sponsored by the American Welding Society, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Society of Civil Engineers, and the American Institute of Mining and Metallurgical Engineers. Actually, therefore, it is the welding research organisation of the engineering societies of the United States.

The growth of the Council has been impressive. It started with an initial grant of $7000 from the Engineering Foundation. The budget has grown steadily and for the last several years has been of the order of $250,000 annually. Unfortunately, or otherwise, the greater portion of these contributed funds have been earmarked for specific research projects.

The philosophy of the Council is quite simple. First of all, it believes in the stimulation of welding research by others. One of the most important tasks undertaken by the Council is in the matter of inducing the different universities to undertake welding research. This is done under the auspices of a special committee known as the University Research Committee. Each year this committee compiles a list of problems needing solution, with some attempts at their formulation. If a university becomes interested in any specific problem, the committee assists in further formulation of the problem in supplying bibliographies, specimens and small grants-in-aid. When sufficient interest and progress is indicated, the committee

might establish fellowships at the university for a continuation of the work on a much more rapid scale. All in all, the University Research Committee has interested some thirty universities to carry out research work in the welding field. The by-product of this particular stimulation, however, is probably more important to the welding industry than the actual results themselves. In this way professors and students become interested in welding research matters and industry obtains a needed supply of carefully trained young men. It was indeed fortunate from the viewpoint of the war effort that the Council had, over a period of years, established these contacts and provided government agencies with laboratories equipped and trained in the welding research field.

Research work, to be of any value, must be utilised by industry. The first task is to disseminate the information promptly and widely. This has been done with an arrangement with the American Welding Society whereby a separate section of its monthly *Welding Journal* is given over to the Welding Research Council and is known as the *Welding Research Supplement*. Some of the best papers presented before the Society at its annual meetings are those coming from the different research workers of the Council.

Development of Activities

It is somewhat curious to trace the development of the welding research activities of the Council. Although at first most of the investigations were aimed at furnishing engineering and design data badly needed by code-making bodies, the trend has been decidedly toward fundamental research. Perhaps two examples will serve to bring out the reason for this trend.

(1) *Weldability Investigations*. The American Welding Society Bridge Committee, in writing its specifications, found it necessary to limit the carbon and manganese content of the steel used in bridge construction to 0.25 per cent. carbon and 1 per cent. manganese. Immediately, there was objection on the part of the steel industry and an investigation was started over a whole range of carbon and manganese contents in plain carbon steels. They determined the metallurgical changes in the steel with a given speed of welding and a given parent metal. After the preliminary work was done on a selected number of steels and thicknesses, it became apparent that a much more fundamental approach would be needed if we were to cover all the combinations and types of steels that would be used in welded construction. Developments proved that the use of the Jominy test and the slow notch can cover the requirements.

(2) *Weld Stress Investigations*. During the war we experienced quite a number of cracked plates in ship construction and the failure of several ships which had been welded. Similar failures occurred in other field-erected structures, notably large gas-holders. The simplest explanation offered was that these failures were due largely to residual welding stresses. Many investigations were started under government auspices for the measurement of local residual welding stresses, with attempts at the control of these stresses. It soon became apparent that almost any fusion-welded joint would produce local residual welding stresses up to the yield point of the material. The investigations then centred around what happened to these residual stresses in service.

From laboratory tests it has not been possible to discover any difference in behaviour of a welded structure with or without these local residual stresses under ordinary service conditions. There is still some uncertainty as to the effects of these stresses on corrosion and under impact at very low temperatures. In large structures the more general residual stresses, referred to as "reaction stresses," are believed to be instrumental in progressing a crack once started. It is well known that structures which have been given a thermal stress relieving treatment behave better under service than structures which have not been so thermally treated. More fundamental work will have to be done to discover whether this improvement is brought about through the elimination of gases such as hydrogen and oxygen, improvement in metallurgical structures, or to the reduction of the residual stresses as formerly believed.

Design and Workmanship

In any event, welding does give a more rigid structure than a riveted joint. This will necessitate a great deal of fundamental research centred on the flow and fracture of metals at ordinary temperatures and at low winter temperatures. It is believed by many that the quality of steel is one of the most important factors to be considered in all of this work. More and more attention is being paid to the necessity for careful design and good workmanship. It is firmly believed that this research work will eventually result in improvement of steel specifications and in the quality of steel generally.

One of the latest additions to the committees of the Welding Research Council has been the Pressure Vessel Research Committee. Work in this field will start on the annual basis of $75,000. The work has been divided into four divisions, namely, materials, design, fabrication, and testing and inspection. Other large projects of the Council include resistance welding research, fatigue testing, and structural investigation.

The Council has, from the very beginning, maintained close relationship with the similar body in Great Britain.

Drying Oils and Oil Seeds

Continued Shortage Likely

At a meeting of the London section of the Oil and Colour Chemists Association on September 26, Mr. G. T. Bray, F.R.I.C., read a paper on "Drying Oils and Oil Seeds in the British Empire." He said that during the war the supplies of such oils for the paint and varnish industry were necessarily restricted, but it had been hoped that when the war was over the supply position would be eased. The fact was, however, that the supplies of linseed oil available might be smaller than ever for some time and such supplies as were obtained would cost twice as much as they did.

Therefore, it was only natural to look around to see if there was any oil not at present in large scale use which could replace partly or wholely the oils previously used. There was also the question whether the usual supplies of raw materials could be obtained from countries other than those which previously supplied them, and whether increased supplies could be obtained from existing sources by increasing acreage. Before the war, supplies of linseed oil were mainly imported from British India and the Argentine, although a certain amount of seed and oil came from Canada. The following figures of the total consumption of linseed oil in this country spoke for themselves: In 1938, 101,500 tons; in 1943, 152,100 tons; in 1944, 83,000 tons; and in 1945, 50,600 tons. The figures of imports from India and the Argentine indicated clearly that in recent years the imports of linseed and oil into the United Kingdom had decreased very considerably and, in spite of larger requirements, the amount of oil available was less than it was in 1938.

Restriction of Exports

In India there was an ordinance restricting the export of oil, including linseed, the purpose being to conserve supplies, while the Argentine, in 1944, had placed an embargo on the export of linseed. In May, 1945, a trade agreement was entered into between the Argentine and the U.S.A. by which it was agreed to send to the U.S.A. all exportable linseed oil and linseed in exchange for fuel oil and coal. Linseed oil had been used as a fuel in the Argentine for some time because they were unable to import coal. Another point was that crushing mills were then operating, and whereas a few years ago the Argentine exported seed they now exported oil instead. It was estimated that the capacity of the Argentine for processing linseed was now 1,000,000 tons a year, which was almost as large as the estimated crop.

India produced 391,000 tons of linseed in 1945, and Canada 185,000 tons, while smaller amounts had been grown elsewhere in the British Empire. Linseed had even been grown in the British Isles to provide linseed cake as food for cattle. The Irish Free State had also shown it was possible to grow linseed there but, as far as he was aware, there was no real industry there. Australia had encouraged its growth, as had other parts of the Empire, especially Rhodesia, Irak and the West Indies. In 1938, we imported some 1,700 tons of linseed from Iraq, but on the whole, there did not seem to be much promise of a big increased acreage of linseed.

Tung Oil Crop Mystery

Referring to tung oil, Mr. Bray said that up to a few years ago all commercial supplies came from China. The greater part of the 68,000 tons produced in 1938 went to the U.S.A., only about 6,000 tons coming to the United Kingdom. Detailed statistics of the exports of tung oil from China since 1938 were not available. Owing to the war, the shipments to this country fell severely and during the first six months of 1946 only 4,000 tons had been exported from China, against an estimated production of 40,000 tons, of which 20,000 to 25,000 should be available for export. There seemed to be no record where this had gone. The U.S.A. was by far the chief importer and consumer of tung oil and therefore it was only natural that attempts should have been made to produce it in the States. Starting in 1905, the U.S.A. went in for tung oil production on a large scale. The American Tung Oil Corporation had followed up the early trials and the total U.S.A. acreage was now some 100,000 acres; although a bigger acreage than that had been planted, a large number had had to be abandoned owing to the unsuitability of the locality and the soil. All the plantations were in the Southern States, but the American Continent was not ideal for tung oil production owing to the danger of early frosts and the result was that the crop varied from year to year. In spite of all that had been done there the output was nothing like sufficient to supply America's own needs. The U.S.A. production of tung oil in 1943 was 2,300 tons, and in 1944 only 1,100 tons, an instance of the varying crops due to the incidence of early frosts.

A great deal of research work had been carried out in the British Empire into the cultivation and production of tung oil. As far back as 1917, under the auspices of the Imperial Institute, cultivation trials of tung trees were carried out in various parts of the Empire but the results failed to produce what was hoped for. Tung oil was

obtained from two trees. In 1938 the matter was taken up again and the trials this time were under the auspices of the Imperial Institute, in association with Dr. Jordan, of the Paint Research Station, and the Director of the Royal Botanical Gardens, Kew. The seeds of both trees were sent out to various countries. These trials went on until 1933 with varying results—in many cases disappointing. However, the commercial production of tung oil was newly started in Nyasaland, Burma, South Africa and Australia. In South Africa, the crop yielded 15 tons in 1939, and although the figure went up to 270 tons in 1943, the results on the whole were not very encouraging. In Nyasaland a Tung Development Station was established with the aid of a grant from the Colonial Development Fund, and a Tung Growers' Association formed. In 1942 a factory for crushing seed was operated there for the first time. Production at present was only about 60 tons a year. The development of tung had also been tried in India but so far as was known there was no large-scale commercial undertaking operating.

Burma gave every encouragement, and in 1939 the Tung Oil Estates, Ltd., was formed, cultivating about 5000 acres. Australia had done a certain amount of experimental work, but nothing very much seemed to have come of it. In 1939-40, about 19 tons of oil were produced. There were plantations of tung in South America and Brazil, the latter producing 200 tons in 1942 and rather less in 1944. Paraguay also had a small production.

Perilla Oil for Paint

Another paint oil, which was used to a very small extent in this country but more extensively in America, was perilla, which was obtained from Manchuria. The use of this oil had been greatly increasing in America up to the outbreak of the war. In 1938, Manchuria produced 114,000 tons, of which America took 20,000 tons, the seeds containing about 40 per cent. of oil. Perilla also grew indigenously in India, and from time to time samples of perilla seed from several districts in India had been received by the Imperial Institute. All of them gave satisfactory yields of oil, but it was never possible to get the Indians to produce any large quantity of the seeds. In pre-war years the Imperial Institute instigated trials of perilla in various parts of the Empire, the most favourable results being obtained in South Africa. One of the troubles, however, was to harvest the very small seed, which was easily shaken out of the capsule and lost. The U.S.A. had also tried growing perilla with erratic results, and in consequence no industry had been established there. Generally speaking, there did not seem any prospect of getting supplies increased either from new cultivations or from Manchuria.

Oiticica did not concern the British Empire because it was not grown there. Both South America and Trinidad had made one or two attempts to cultivate it, but the results were not satisfactory.

Candle Nut Oil

Mr. Bray said that one or two other oils had been suggested for use in paint. There was a species of tree growing in the Philippines, Malaya, Australia, Java and Fiji from which candle nut oil was obtained. The kernels contained from 55 to 60 per cent. of oil, but the shell containing the seeds was very hard and there was great difficulty in devising a machine for decorticating them without breaking the kernels. Recently, a company had been formed in Australia for the purpose of exploiting the candle nuts which were available in Fiji and certain parts of Australia, and it was claimed that some means had been found for decorticating the nut and getting out the kernel satisfactorily. No figures of the quantities of nuts available had been issued, but the company concerned had stated that there were plenty of them. This oil had been used in the U.S.A. when there was a shortage of linseed oil or when the price of the latter had been sufficiently high to make the utilisation of the candle nut remunerative. In drying properties it compared favourably with linseed oil. It was used locally as a paint-drying oil in the Philippines, Java and elsewhere. A small quantity of the nuts had been exported from the Philippines to the U.S.A.

Castor oil, in itself, was not a drying oil, its iodine value being 80 to 90, but it could be processed to give a product which, to some degree, had the properties of tung oil. The castor oil plant grew largely in the tropics, principally in India, Java, Brazil, U.S.A., and Italy. The main supplies, however, came from India and Brazil. The production of castor seed in India was over 100,000 tons a year and yet in 1944-45 less than 1000 tons came into the United Kingdom. Castor seeds were also to be found in areas scattered along the East and West coasts of Africa. In Nigeria, castor oil was used as a lubricant to save the import of mineral lubricants, but he did not know whether it was practicable to encourage the natives in these parts to make more of their indigenous castor plants. If castor oil, after processing, met the requirements of the paint trade, it was possible—he would not say probable—that supplies from parts of the world where the plant was indigenous might be increased, for in many countries it only needed collecting

Mr. Bray said that grape seed oil, suggested as of possible use for the paint industry, was used on the Continent, and was

usually a waste product. The oil content of the seed, however, was only 11 or 12 per cent., and this suggested it should be solvent-extracted rather than expressed. In 1941, Germany produced 1500 tons, Italy 10,000 tons and Spain 5000 tons. The type of oil, however, varied with the type of grape. Australia occurred to him as the only country in the British Empire where it would be worth while starting an industry to recover oil from grape seed, but it was impossible to say whether it would be economic. The soya bean had been cultivated in a number of places, but there was no chance of getting supplies for the paint industry. But oil from the shell of the cashew nut did possess possibilities. Unfortunately, however, the supplies were limited and a great deal of the oil was wasted in the preparation of the kernel by the old native methods. If more people would adopt modern methods of recovery as in India and, he believed, in South America, larger quantities would be made available. Ground nut oil he would not mention because the Ministry of Food was doing all it could to encourage this for the sake of the oil for edible purposes.

Concluding, Mr. Bray said that supplies were likely to continue to be short by reason of the fact that many of the oils used in the paint and varnish industry were also valuable for foodstuffs and in the present state of the world these were regarded as more important. In some countries even linseed oil was consumed by human beings. Therefore, the best chance of obtaining material for the paint industry was in increasing the supplies of oils which were not edible.

Tubular Reactors

Chemical Engineers Meet in Manchester

THE first meeting of the third session of the Institution of Chemical Engineers, North-Western branch, was held at The College of Technology, Manchester, on September 28, when a paper, "Tubular Reactors," was read by Dr. K. B. Wilson and Mr. G. J. H. Tasker.

Dr. Wilson described the calculation and the analysis of longitudinal temperature gradients in tubular reactors. These reactors are most commonly used in vapour-phase catalysis and the purpose of the paper was to obtain design data for such a reactor and to forecast its performance. He assumed that the rate of reaction is a function of the concentration of one principal reactant and of its temperature, the other reactant being present in large excess, that the radial temperature of the catalyst in the tube is uniform and any change in temperature takes place at the wall of the tube, and that the particles of the catalyst are small compared with the diameter of the tube.

A heat balance along a small element of the tube length was taken, and a calculation of the heat reaction along this element was made and was divided into its fractions; (a) transmitted through the tube wall; (b) taken up by the gases or vapours; (c) conducted along the catalyst; and (d) radiated from the catalyst to the tube wall. In general, the heat conducted along the catalyst was omitted and the radiant heat was included in the heat-transmission coefficient of the tube surface. The equation showed a maximum temperature at one point on the tube for an exothermic reaction and a minimum temperature for an endothermic one. Corrections were applied to the equations for the change in concentration of the reactant with temperature and with its velocity. A graph gave the variation of the temperature along the tube length and the heat-transmission coefficient was found for the tube surface.

As a complete solution of the equation was difficult, step-wise calculations of the variables were made. Various methods were given for the calculation of the rate of reaction. Having completed the evaluation of the variables, the author calculated the percentage conversion of the reactant per unit length of the tube and the corresponding temperatures of the tube along its length.

To show the practical application of this work, Dr. Wilson gave details of the catalytic vapour-phase reduction of nitrobenzene, and close agreement was obtained between the calculated and the experimental results for the temperature distribution along the length of a tubular reactor.

Mr. Tasker, in his portion of the paper, applied the theory to phthalic anhydride pilot-plant data, and the calculation of heat transfer and of reaction rates in catalyst beds were given. Three tubes, packed with catalyst, were expanded into tube plates and surrounded by a cadmium amalgam bath. Naphthalene vapour and an excess of air were passed through the catalyst and the reaction, which produced much heat, was taken as at least 75 per cent. conversion to phthalic anhydride with a maximum yield of 25 per cent. carbon dioxide. Rates of reaction were obtained from a curve of temperatures against the length along a tube, intervals of 1 in. or less being taken. The heat produced by the reaction was divided into the fractions removed by radiation, by convection, and as sensible heat. The over-all heat-transfer coefficient was plotted against the mass velocity of the gases and was used to calculate the rate of reaction as a function of the linear distance along a tube containing the catalyst. From this curve the total conversion along the length of the tube could be obtained.

Parliamentary Topics

Filter Presses

IN the House of Commons last week. Captain Crowder asked the President of the Board of Trade what the position was regarding the supply of filter presses for the china clay industry.

Mr. Belcher replied that the manufacturers of filter presses were heavily loaded with orders from many of the industries using such filters and it was inevitable that there should be a long delay between the placing of orders and the delivering of filter presses, but the Minister of Supply was doing his best to assist their production.

Soap Ration

Major Beamish asked the Minister of Food whether he was aware that men employed as coal millers, cement millers and in lime plants felt that the soap ration provided was inadequate for their dirty clothes, which needed frequent washing; and whether he would allow an increased ration to such workers.

Mr. Strachey replied that the continued shortage of fats prevented his acceding to the request.

Meta-rich Cresylic Acid

The Minister of Fuel, replying to questions asked by Lieut.-Col. Sharp, said his Ministry worked closely with the tar distilling industry to secure the maxmum amount of meta-rich cresylic acid of grades suitable for the plastics industry from the crude tar production of the country. No system of allocation was in operation. Production in the first half of 1946 was approximately the same as in the first half of 1945. Statistics for 1938 were not available, but it was known that meta-rich grades were not extracted to the same extent as they were now. As its production depended in the first place upon the amount of coal carbonised, it was not expected that there could be any appreciable increase under present conditions. No meta-rich cresylic acid was exported and there was no known available source of supply for import.

Stocks of Natural Rubber

Sir Stafford Cripps, in answer to questions put by Sir J. Mellor, stated that the average purchase price of Government stocks of natural rubber in the U.K. at the end of September was approximately 1s. 2d. per lb. f.o.b. country of origin for No. 1 sheet. No arrangements had been made to liquidate those stocks, but certain quantities were being sold to consumers in the U.K. at 1s. 4d. per lb. delivered to works, and to other countries at 1s. 4d. per lb. f.o.b. Under the recent agreement between the Board of Trade and the Rubber Development Corporation of U.S.A., some part of that stock might be sold to the U.S.A. before the end of the year at the price of 22¼ cents per lb. c.i.f. U.S. Atlantic port.

German Potash

Mr. J Hynd, replying to a question by Lieut.-Col. Corbett, stated that in July and August of this year the total producion of potash fertiliser in the British zone of Germany amounted to 76,400 tons, all of which was retained in the zone.

Price of U.K. Tin

Commander Agnew asked the Minister of Supply whether, following the announcement of the price payable for tin produced in Malaya and Nigeria, he would state the price payable for the same commodity produced in the U.K.

Mr. Wilmot replied that the price paid varied with the costs of production. The average price paid to the producers in 1945 was £456 a ton of tin in ore.

New Zealand Fertilisers

Increased Output

PRODUCTION of chemical fertilisers in New Zealand in 1944-45 was valued at £1,890,683, as compared with £1,553,289 in 1943-44 and £1,586,480 in 1942-43, according to a report from Auckland. The increased output was made possible by an improvement in the volume of phosphate rock available from overseas sources.

Before 1941, the principal product of the chemical fertiliser industry had been "straight" superphosphate or mixtures of this containing small percentages of other ingredients. After 1941, in order to spread the available supplies further, the production of serpentine superphosphate, containing approximately 25 per cent. of crushed serpentine rock, became general in the North Island works. In the South Island, there was considerable production of basic or reverted superphosphate, containing 10 per cent. of crushed limestone.

The total value of materials used in the industry in 1944-45 was £1,107,655. The principal items, with the cost of each, are as follows: rock phosphate, £420,483; sulphur, £258,783; nitrate of soda, £15,550; serpentine rock, £39,198; carbonate of lime, £25,340; potash, £64,879; organic manures, £5,618; and other materials, £277,804.

Shortly after the outbreak of war, the Government, in furtherance of its policy of stabilising costs and prices, found it necessary to pay certain subsidies to manufacturers to offset the increased cost of rock phosphate, bags, etc. Since then it has been found necessary to revise these subsidies from time to time.

Organon Laboratories

Proposed New Factory in Scotland

TOWARDS the middle of 1947, Organon Laboratories, Ltd., will move from the Wimbledon Estate into a new and larger factory built for them by the Board of Trade in the Glasgow development area.

The company manufactures a range of technically very specialised pharmaceutical products, notably the hormones. It has a rapidly expanding export market as well as a substantial home demand. During the war, by reason of the essentially medical nature of its products, the company was enabled, by the help of some Government departments, to pursue an export programme. Action is now being taken to expand this export market as much as possible. The company attaches great importance to the perfect standardisation and purity of its products; and some testimony to the standards reached is the fact that the company held Government contracts for hormones during the years of war.

The new factory will have an area of 55,000 sq. ft. and will stand in 10 acres of its own grounds. It will consist of nine blocks, each a standard Board of Trade unit. Most of these will be separate, and have allocated to them a particular chemical and pharmaceutical process. Modern stainless steel plant will be installed. Sterile rooms will be specially constructed with a filtered, bacteria-free air supply. There will probably be employment for 250-400 people, most of them women. In addition to modern welfare arrangements, encouragement will be given to employees to continue education to university degree standard.

German Technical Reports

Latest Publications

SOME of the latest technical reports from the Intelligence Committees in Germany are detailed below. Copies are obtainable from H.M. Stationery Office at the prices stated.

CIOS XXIX—12 (Appendix) *Dr. O. Bayer (I.G. Farben. Leverkusen)*: *Polyurethanes*. (Translation of CIOS XXIX—12). (2s.).

BIOS 572. *Investigation into manufacture and use of carbon black and lamp blacks in Germany.* (10s. 6d.).

BIOS 616. *Inspection of Krupp-Lurgi plants for the carbonisation of coal at low temperatures.* (4s.).

BIOS 623. *Lurgi Gesellschaft Fuer Warmetecknik, Frankfurt-am-Main*: A, the Phenosolvan process; B, the Magdeburg-P process; C, the Metasolvan process (the solvent extraction of phenols from tar oils with special attention to low temperature carbonisation oils). (2s.).

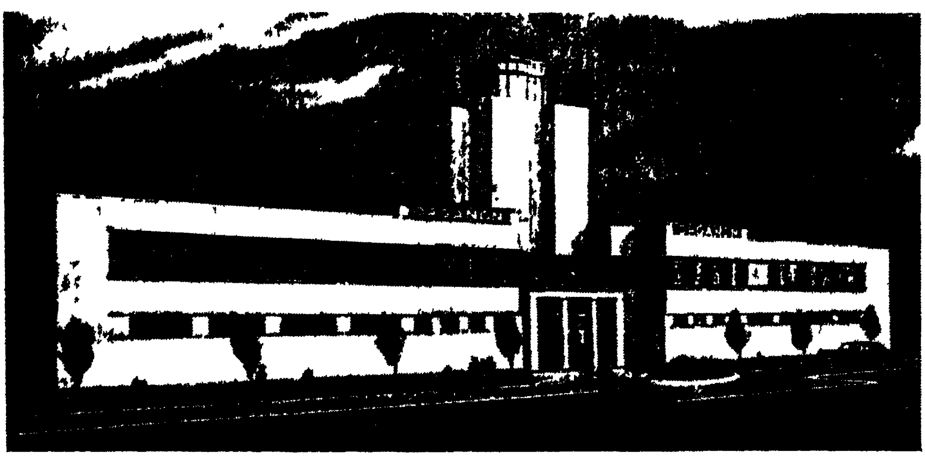
BIOS 626. *Drying, briquetting and low-temperature carbonisation of brown coal in Lurgi-Spuelgas retorts.* (2s.).

BIOS 683. *Deutsche Gold and Silber Anstalt*: Hydrogen peroxide—production by electrolysis of 35 per cent. solutions.

BIOS 708. *German Alkaline Accumulator Industry.* (1s. 6d.).

BIOS 713. *Notes on items of chemical plant at works of I.G. Farben., Knapsack; Dr. Alexander Wacker, Burghausen; Anorgana, Gendorf; I. G. Farben, Hoechst.*

BIOS 715. *I.G. Farben, Elberfeld-Wuppertal*: Microanalytical methods employed in the analytical laboratories. (1s.).



An artist's impression of Organon's proposed new factory and laboratory

Personal Notes

DR. CHARLES KEMBALL, Ph.D., has been elected to a Research Fellowship at Trinity College, Cambridge, for research in physical chemistry.

DR. J. D. COCKROFT, C.B.E., Jacksonian Professor of Natural Philosophy in the University of Cambridge, has been elected to an honorary fellowship at St. John's College.

MR. H. J. BUNKER, who has been elected president of the Society for Applied Bacteriology, is secretary of the Microbiological Panel of the Food Group, Society of Chemical Industry, and hon. treasurer of the Society for Applied Bacteriology.

MR. C. G. MCAULIFFE, who recently relinquished the Control of Light Metals in the Ministry of Supply, has taken up an appointment as a departmental manager in the sales division of the British Aluminium Co., Ltd., Salisbury House, London Wall, London, E.C.2.

DR. GEORGE LEWI, D.Sc., A.F.C.D.I., industrial consultant, London, has been appointed chemical adviser to the Directorate General of the Czechoslovak Nationalised Chemical Industries in Prague for the British Empire and the U.S.A. MR. DAVID LEE, B.Sc., A.R.I.C., after release as personal assistant to the Controller, Chemical Defence Development, Ministry of Supply, is joining Dr. Lewi as his personal assistant.

Obituary

MR. W. J. LIVESEY, whose death occurred on October 8 after a short illness, had been general manager and secretary of the British Copper Sulphate Association, Ltd., since its inception in 1942.

Glass Fabrics

Elimination of Defects

AN important stage has been reached in the manufacture of glass silk fabrics, at which certain of the defects inherent in the material, have, in the opinion of the manufacturers, been eliminated. The effect of this development is to make glass silk fabric, in its newer form, a practical textile. The defects were such as to permit the production of a silk fabric, not unlike a taffeta, which was however, subject to fraying and to abrasive action and which would not give satisfactory service in daily use.

Recent experiments have produced a material which resembles a leathercloth or furnishing textile, and which is similar to plastic sheeting. Among the advantages claimed for it are that it is immensely strong, cuts cleanly and without stranding or fraying, and is free from abrasion. It is produced in a very wide range of colours, in selfs, or in printed form. It is strong enough to print smoothly, and to take accuracy of register in multicolour printing. Examples in matt-surfaced pastel shades demonstrate that the earlier difficulties associated with dyeing of the silk have been overcome in the coating process. Figures in several colours were overprinted, with a high degree of accuracy.

Many of the advantages inherent in glass have been retained in the new fabric.

The unique qualities of the material suggest that it will get a welcome from makers-up, although there are still defects in this new type which limit its use to the heavier purposes. It would not, for instance, be suitable as a dress fabric, or a lingerie material. It has no stretch worth mentioning and is consequently not a corsetry material, apart from any other aspect.

It will find a positive market as a furnishing fabric and can be used as a table covering or for wall furnishing. It will compare with plastics, leathercloths and similar materials. The glass fabric is produced by Fbreglass, Ltd., at Firhill, Glasgow.

Safety in Oxygen Plants

Removal of Impurities

DANGER of explosions in plants producing oxygen by the liquefaction and rectification of air may be reduced by eliminating acetylene and other hydrocarbons from the air, says the *Journal of Chemical Education*, quoting an American report. Evidence of the explosive effect of acetylene and other hydrocarbons upon oxygen under production is scanty; however, the existence together of solid acetylene and liquid oxygen at some points in operating units where explosions have occurred seems to indicate that this combination is a danger factor. Acetylene, the most important impurity, may be removed by both catalytic oxidation and adsorption on active charcoal.

Among other contaminating agents mentioned as being found in small quantities in ordinary air, particularly in industrial areas, are ozone, nitrogen oxides, carbon monoxide, acetylene and other hydrocarbons. The danger attending the accumulation of ozone in oxygen units is emphasised.

The output of petroleum in Argentina during the first half of 1946 is officially stated to have been as follows: State-owned wells, 1,114,152 cubic metres; privately-owned wells, 529,380 cubic metres. A continued decline in production is understood to be due mainly to the shortage of oil-drilling machinery.

General News—From Week to Week

The Anglo-Italian telephone service has now been extended to include all parts of Italy, Sicily and Sardinia.

Sir Stafford Cripps told a fuel conference that it would be "touch and go" whether we should get through the winter without some hold-up, either of domestic or irdu tria, supplies of coal.

Owing to the coal shortage the British steel industry fears difficulties in production may arise in the early part of the coming winter, states the current *Bulletin* of the British Iron & Steel Federation.

The Board of Trade is now prepared to receive applications for licences to import limited quantities of plastic (P.V.C.) floor covering from any country before the end of 1946.

The Institution of Chemical Engineers has received a suggestion from the American Institute of Chemical Engineers that it should visit the U.S.A. for a joint meeting at Detroit in November, 1947.

At Widnes Municipal Technical College, three students were awarded Higher National Certificates in Chemistry, and six obtained Ordinary National Certificates, having successfully completed approved part-time courses during last session.

The formation of a South Wales section of the Society of Instrument Technology is under discussion, and a meeting has been held to arrange details. Those interested should get into touch with Mr. O. G. Pamely Evans, 7 Museum Place, Cardiff.

For the second time within a week the price of platinum has been reduced, on this occasion by 30s. to £20 a troy ounce. The latest quotation showed a fall of £3 5s. an ounce from the price reached a month ago and maintained until the beginning of last week.

According to Sir Charles Ellis, scientific director of the National Coal Board, each of the eight regional divisions of the Board is to have a scientific research organisation, directed by a chief scientist. Laboratories, in which coal problems are to be worked on, will be established in each division and area, and, in some cases, in sub-areas.

A claim was made at York on Tuesday last week for the establishment there of a collegiate residential university. A meeting of representative citizens, presided over by the Lord Mayor, Alderman Gaines, elected a committee to prepare the city's case for presentation to the University Grants Committee. The Dean of York, and the Headmaster of Bootham School were among the speakers who supported the scheme.

The Minister of Food announces that no changes will be made in the prices of refined oils and imported edible animal fats allocated to primary wholesalers and large trade users during the eight-week period October 13, 1946, to December 7, 1946.

Now that increased quantities of natural rubber are becoming available for international allocation, the Combined Rubber Committee has agreed that control need not continue beyond the end of this year. The Member Governments have agreed that the Committee be terminated on December 31, 1946.

Wholesale prices in September, as measured by the Board of Trade index number, continued the slow steady rise of recent months and were 0.4 per cent. higher than in August. In the "chemicals and oils" group, the index number was 151.3, an increase of 2.1 per cent. compared with August, due to the greatly increased cost of linseed oil.

Arrangements are now being completed for British Celanese, Ltd., to take over 214 acres of the Government factory site at Marchwiel, Wrexham, for the extension of its plastics and textile production. It is hoped to begin limited production, employing 300 workers, by the end of the year, and it is expected that 5000 workers will be engaged when new plant and alterations to existing buildings have been completed.

Representatives of the Dutch Federation of Industries were received by a delegation of the F.B.I. in London on Wednesday and Thursday last week. Among the Dutch visitors were Mr. W. H. van Leeuwen, N.V. Nederlanse Gisten Spiritusfabriek, Delft (yeast and alcohol industry); Mr. C. van Loon, N.V. Vereenigde Stearine Kaarsenfabrieken "Gouda-Apollo," Gouda (stearine, oleine, oil and grease refining); and Mr. A. H. Ingen Housz, N.V. Koninklijke Nederlandse Hoogovens en Staalfabrieken, Ymuiden (blast furnaces, nitrogen fertilisers, etc.). Chemical interests on the British side were represented by Sir Frederick Bain, M.C., of I.C.I., and Mr. J. H. Hansard, of Lever Brothers and Unilever.

Foreign News

Production of coal in Germany rose by 2,170 tons to 179,000 during September.

Tablets containing fluorine compounds for warding off dental decay will be available soon in America on prescription.

Japan's heavy chemical industry produced in June about 32 per cent. of minimum needs. The main bottleneck is still the fuel supply position.

Under a recently concluded agreement, Austria will supply France with 3000 tons of magnesite in exchange for mechanical materials and argon gas.

The Soviet-Hungarian Oil Co. has discovered new deposits of oil and natural gas between the rivers Danube and Tisza; borings are in progress.

Mexican production of white arsenic in 1945 amounted to 15,712 metric tons, worth about £265,600, states the Mexican Bureau of Mines.

Italy's match industry suffered very little war damage, and thanks to the modernisation of plant, the industry's capacity is at present higher than before the war.

A million tons of Swedish iron ore is to be purchased by the Bethlehem Steel Corporation. It is understood that the high quality of the ore is considered sufficient to compensate for the transportation costs.

Work is being speeded up in connection with the construction of port facilities at Iquique, Chile, for storing and shipping nitrate of soda in order to deal with the increased demand from Europe.

France has agreed to permit the import, from Switzerland, of chemical products for pharmaceutical and veterinary purposes, including specialities in original packages, up to a value of 15,000,000 Swiss francs.

Wartime research on paints in America revealed that the addition of aluminium powder to priming coats improved the fire-retarding properties of paints used on interior surfaces of ships.

An association of Japanese penicillin manufacturers has been formed to exchange information, to establish a method of testing, to increase production and to control distribution of penicillin.

Increasing concern is being voiced, both by Italian agricultural interests and by the chemical industry, over the recent decline in the volume of imports of phosphates from French North Africa.

The London rubber market, it is expected, will be revived as a result of the decision to bring to an end the Combined Rubber Committee in Washington which supplies raw rubber to consuming countries.

Forthcoming Events

October 21. The Chemical Society (jointly with the Royal Institute of Chemistry, S.C.I., and the Bureau of Abstracts). London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1, 6 p.m. Dr. G. M. Dyson: "A New Notation for Organic Chemistry."

October 22. Hull Chemical and Engineering Society (jointly with Yorkshire section of S.C.I.). Church Institute, Albion Street, Hull, 7.30 p.m. Mr. T. Andrews: "Modern Trends in the Whaling Industry."

October 23. British Association of Chemists. Gas Industry House, Grosvenor Place, London, S.W.1, 7 p.m. Mr. D. Matheson: "Fire and Explosion—II."

October 23. Irish Chemical Association. Chemical Department of Trinity College, Dublin, 7.30 p.m. Dr. V. C. Barry: "Anti-tubercular Compounds" (presidential address).

October 23. Royal Statistical Society (Industrial Applications section, Birmingham and District group). Chamber of Commerce, 95 New Street, Birmingham, 6.30 p.m. Mr. A. S. Wharton: "Market Research."

October 23. Society of Chemical Industry (Food Group). Chemical Society's Rooms, Burlington House, Piccadilly, London, W.1, 6.30 p.m. Mr. D. W. Grover: "The Keeping Properties of Confectionery as Influenced by its Water-Vapour Pressure"; Mr. H. F. Bamford and Mr. H. M. Mason: "Estimation of the Fineness of Grinding of Chocolate."

October 24. International Society of Leather Trades' Chemists (British Section, Northampton group). College of Technology, St. George's Avenue, Northampton, 2.30 p.m. Dr. M. P. Balfe, F.R.I.C.: "Currying and Fatliquoring."

October 24. The Chemical Society (jointly with Sheffield University Chemical Society). Chemistry Lecture Theatre, Sheffield University, 5.30 p.m. Professor A. R. Todd: "A Synthetic Approach to the Nucleotides."

October 24. Royal Institute of Chemistry (Manchester and District section, jointly with Chemical Society and Manchester University Chemical Society). Chemistry Department of Manchester University, 7.30 p.m. Professor Wilson Baker: "The Chemistry of Penicillin."

October 25. Society of Instrument Technology (Scottish section). Royal Technical College, Glasgow, 7 p.m. Mr. T. C. Brodrick: "Fundamentals of Automatic Control."

October 25. The Chemical Society (jointly with the Alchemists' Club and the Andersonian Chemical Society.) Royal Technical College, Glasgow, 3.45 p.m. "Evidence Concerning the Mode of Action of Vitamins."

October 26. Institution of Chemical Engineers (North-Western branch, jointly with Liverpool section of S.C.I.). Stork Hotel, Queen Square, Liverpool, 3 p.m. Dr. L. J. Burrage: "Some Aspects of Adsorption by Activated Charcoal."

October 26. Royal Institute of Chemistry (London and South-Eastern Counties section). Letters Lecture Theatre, Reading University, 2.30 p.m. Professor H. L. Hawkins: "The Geology of Water Supplies"; Mr. W. Gordon Carey: "The Chemistry and Bacteriology of Water Supplies."

October 28. Society of Chemical Industry (Agriculture and Food Groups). Chemical Society's rooms, Burlington House, Piccadilly, London, W.1. 6.30 p.m. Professor G. L. Baker: "Agricultural Delaware and its Supporting Research"; Professor J. A. Scott-Wilson: "Agricultural Research and Farming Progress."

October 29. Hull Chemical and Engineering Society. Jackson's Restaurant, Paragon Street, Hull, 7.30 p.m. Annual dinner.

October 29. Society of Instrument Technology. Royal Society of Tropical Medicine, Mansion House, Portland Place, London, W.1, 7 p.m. Mr. S. Hill: "The Standard-Sunbury Engine Indicator."

October 29. The Chemical Society (jointly with Edinburgh University Chemical Society and local sections of R.I.C. and S.C.I.). Edinburgh University, 7 p.m. Dr. D. J. Bell: "Some Observations on Biological Oxidation and Reduction."

Company News

Geevor Tin Mines, Ltd., report a net profit, to March 31 last, of £12,319 (£16,549). A dividend of 10 per cent. is proposed.

The nominal capital of **New Metals and Chemicals, Ltd.,** 4 Broad Street Place, E.C.2, has been increased beyond the registered capital of £10,000 by the addition of £10,000, in £1 "B" ordinary shares.

New Companies Registered

General Chemical Products, Ltd. (420,735). —Private company. Capital £100 in £1 shares. Manufacturers of and dealers in chemicals, etc. Director: A. Appelbe. Registered office: 7 New Square, W.C.2.

Bexley Chemical Co., Ltd. (420,905).—Private company. Capital £100 in £1 shares. Manufacturers of and dealers in chemicals, etc. Directors: J. Miles; A. G. Edwards. Registered office: 58 Victoria Street, London, S.W.1.

Technical Metal Treatments, Ltd. (421,035).—Private company. Capital £1000 in £1 shares. Dealers in chemicals for the treatment of metals, etc. Director: A. Watson. Registered office: Rye Lane, Otford, Kent.

Peldo, Ltd. (421,008).—Private company. Capital £100 in £1 shares. Makers of and dealers in industrial chemical articles, compounds and preparations, etc. Directors: E. Bernasconi; H. I. Jones. Registered office: 8 St. George's Street, Hanover Square, W.1.

W. A. Townsend, Ltd. (421,122).—Private company. Capital £4000 in £1 shares. Manufacturers of and dealers in chemicals, gases, drugs, etc. Directors: O. J. Betty; G. R. Hannah; E. M. Payne. Registered office: 41 Corn Street, Bristol, 1.

Seatang Products, Ltd. (420,869).—Private company. Capital £100 in £1 shares. Salt manufacturers, dealers in and agents for the sale of salt and chemical products, etc. Directors: G. C. Bingham; S. P. Barns; P. A. Bingham. Registered office: 153 Hamlet Court Road, Westcliff-on-Sea.

Waltham Industrial Chemicals, Ltd. (421,045).—Private company. Capital £1000 in £1 shares. To carry on the business indicated by the title. Directors: W. F. Baldwin and V. H. Forrester. Registered office: Station Approach, Waltham Cross, Herts.

Alfred Green (Chemicals) Ltd. (421,130). —Private company. Capital £2000 in £1 shares. To acquire the business of wholesale chemical merchants carried on by A. Green at Upper Cross Street, Northampton. Directors: A. Green; L. Green. Registered office: Upper Cross Street, Bath Street, Northampton.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Satisfaction

ARLEE, LTD., Ashtead (Surrey), chemical manufacturers. (M.S., 19/10/46.) Satisfaction September 24, of debenture registered March 30, 1943.

Chemical and Allied Stocks and Shares

WITH business in stock markets still on a small scale, prices have continued to show indefinite movements. British Funds displayed renewed firmness, and home rails responded to the companies' case against State ownership, but a fall in Kaffirs unsettled the mining market. Industrials, although helped in some instances by dividend announcements, were uncertain, partly owing to shortages of materials and the fuel situation. In this connection the reduction in Enfield Cables' interim came as a surprise; the directors attribute the reduced payment to the difficulty of forecasting

profits owing to the shortage of lead, etc., and the possibility of a cut in fuel supplies.

Imperial Chemical showed movements not exceeding more than a few pence, and after 42s eased to 41s. 9d. Despite talk of a possible dividend increase, Turner & Newall at 82s. failed to hold an earlier improvement. Goodlass Wall 10s. ordinary strengthened to 29s. on the hopes of improved results from the lead section of the business, and elsewhere among paint shares, Lewis Berger have been firm at £6 7/16 on hopes of a higher dividend for the past year.

Metal Box shares were helped by the big Welsh tinplate scheme, which it is assumed will increase supplies of tinplate as time proceeds. Steel shares strengthened on this scheme, which drew attention to the progressive policy being followed by the industry. Richard Thomas were 11s. 3d., Guest Keen 42s. 1½d., and Brightside Foundry 42s. United Steel, however, at 24s. 6d. were slightly lower on balance, although Stewarts & Lloyds firmed up to 50s. Baldwins (Holdings) rose to 6s. 10½d. on the higher dividend and bonus. Colliery shares came in for renewed attention under the lead of Lambton Hetton, which at 22s. 6d. gained 2s. 3d. following the higher dividend and jubilee bonus. Carlton Main were 41s. 3d., Powell Duffryn 25s., and Bolsover 62s. 6d., while elsewhere, Ruston & Hornsby moved up to 60s. 3d., Allied Ironfounders improved to 57s. 6d., and Babcock & Wilcox to 58s. 9d., awaiting dividend announcements.

Low Temperature Carbonisation continued active, these 2s. shares further improving to 3s. 10½d. Dunlop Rubber eased to 67s. 9d., and Levers at 48s. 9d. were lower, awaiting the dividend decision of Lever N.V., the Dutch company. Elsewhere, British Ropes 2s. 6d. shares were favoured on the view that activity in the heavy industries connotes good demand for the company's products, and the price rose further to 11s. British Glues 4s. ordinary remained firm at 16s. British Industrial Plastics 2s. shares were 7s. 7½d., and De La Rue £12¼. It is generally assumed that when the £1 shares of the latter company are split into four of 5s. each, the latter are likely to commend a higher comparative price. B. Laporte were 98s. 9d., Fisons 54s. 6d., and W. J. Bush 90s., while in other directions, Burt Boulton changed hands at 23s. 9d. Dividend announcement of the last-named company is due shortly. Greeff-Chemicals Holdings 5s. ordinary have changed hands around 11s. 6d., buyers being more in evidence since the recent increase in the interim dividend. British Drug Houses were 52s. British Aluminium strengthened to 40s. 3d. on the view that shortages of other metals are likely to increase demand for aluminium. British Oxygen were 92s. 6d., and Murex 90s. A sharp rise from 41s. to 43s. 3d. in Wall Paper Manufacturers deferred units was attributed to hopes of the pending statement showing improved results. Triplex Glass after 36s. 6d. eased to 35s. 6d., the full results and chairman's annual statement being awaited with considerable interestd for information as to the profit trend during the current financial year. Boots Drug at 57s. 6d. failed to hold all an earlier rally. Beechams deferred were 24s. 6d., Sangers 31s. 6d., and Timothy Whites 52s. 6d. Oils became easier, Anglo-Iranian and Shell both yielding 7½d.

British Chemical Prices

Market Reports

STEADY trading conditions have prevailed in the London general chemicals market during the past week and quotations throughout have continued firm at recent levels. Contract deliveries to the chief consuming industries have proceeded along steady lines and a fair volume of fresh business has been reported, both for home and export account. The flow of supplies remains pretty much the same,. with no apparent improvement in the position of scarce items, and in the paint raw materials section the position has become considerably tighter. Activity in the coal-tar products market is mainly concerned with deliveries against existing commitments, while a ready market is available for spot offers of pitch, carbolic acid, creosote oil, and naphthalene.

MANCHESTER.—A strong undertone continues throughout the Manchester chemical market and there is little sign of easiness in any direction. Although running below its pre-war level, the demand from the cotton textile and allied industries is on steady lines and both contract deliveries and new buying during the past week have been well maintained, while a good inquiry has been reported from other leading industrial outlets. Export demand for caustic soda and other heavy chemicals has been prominent, but shippers are not finding it easy to arrange early deliveries. In the tar products market, values are firm, and with one or two exceptions there is persistent pressure for supplies.

GLASGOW.—The Scottish heavy chemical market is displaying great activity in all sections both for home and export. A very great volume of business is being done against contract and for spot delivery in all classes of heavy chemicals at firm prices. Deliveries in some cases are somewhat slow and in general demand continues to outstrip supply. Export orders are arriving in satisfactory numbers and are covering such products as zinc oxide off-colour grades, Glauber salts, sulphur, saltpetre, Epsom salts, sulphuric acid, and toluol.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Sugar, etc., purification.—American Cyanamid Co. 27407.

Treatment of carbonaceous materials.—C. Arnold. (Standard Oil Development Co.) 27203-4.

Synthetic gas.—C. Arnold. (Standard Oil Development Co.) 27354.

Brass alloys.—Barking Brassware Co., Ltd., and B. Wallis. 27305.

Carbonisation of coal, etc.—S. G. Bartlett. 27170.

Nickel case alloys.—T. F. Bradbury. 27251.

Organic compounds.—British Celanese, Ltd. 27430.

Polymers.—British Celanese, Ltd. 27175.

Plastic materials.—British Celanese, Ltd. 27433-4.

Alkane derivatives.—British Schering Research Laboratories, Ltd., J. S. H. Davies, and P. R. Carter. 27609.

Alkyl derivatives.—British Schering Research Laboratories, Ltd., J. S. H. Davies, and W. H. Hook. 27779.

Lubricants.—British Thomson-Houston Co., Ltd., and T. F. Smeaton. 27179.

Plastic materials.—Bushing Co., Ltd., and H. A. Mouat. 27347.

Anhydrides.—Carbide & Carbon Chemicals Corporation. 27622.

Moulding powders.—W. H. Chatfield. 27232.

Penicillin.—Commercial Solvents Corporation. 27546-7.

Organic compounds.—J. W. C. Crawford, and I.C.I., Ltd. 27557.

Fluorescent glasses.—F. B. Dehn. (Sylvania Products Inc.) 27744.

Treatment of calcium nitrate solutions.—Directie van de Staatsmijnen. 27771.

Treatment of nitrate solutions.—Directie van de Staatsmijnen. 27772.

Calcium phosphates.—Directie van de Staatsmijnen. 27773-5.

Chlorinated derivatives.—Distillers Co., Co., Ltd., and T. Henshall. 27426.

Monoethers of butene triol.—Distillers Co., Ltd., and T. Henshall. 27570.

Reciprocating pumps.—Distillers Co., Ltd., and T. B. Philip. 27280.

Isophorone, etc.—Distillers Co., Ltd., H. C. Highet, and F. E. Salt. 27225.

Aromatic vinyl compounds.—Dominion Tar & Chemical Co., Ltd. 27326.

Dyestuffs.—A. E. van Dormael, P. F. de Smet, and Gevaert Photo-Producten N.V. 27206.

Plastic sheet material.—E.I. Du Pont de Nemours & Co. 27292.

Polychloroprene cements.—E.I. Du Pont de Nemours & Co. 27545.

Dyestuffs.—E.I. Du Pont de Nemours & Co. 27555.

Dyestuffs.—E.I. Du Pont de Nemours & Co. 27701.

Oil dispersing apparatus.—S. L. F. Eklund. 27530.

Diazotype light-sensitive materials.—H. G. C. Fairweather. (General Aniline & Film Corporation.) 27454.

Monochlorbenzene.—A. B. Futo. 27478.

Oil dispersing apparatus.—Gamlen Chemical Co. 27697.

Treatment of sea water.—Gamlen Chemical Co. 27698.

Cellulose.—L. R. Gans. 27348.

Resinous materials.—B. Gluck, W. E. Smith, and C. Shaw. 27766.

Fluid control valves.—Goodmans Industries, Ltd., and J. W. Miller. 27575.

Carboxylic acid solutions.—E. B. Higgins. 27595.

Toxic vapours.—I.C.I., Ltd. 27291.

Carbonisation of material.—C. P. Jenkyns. 27522.

Drying stoves.—J. A. Johnson. 27376.

Aromatic compounds.—Koppers Co., Inc. 27448.

Hydrocarbons.—Koppers Co., Ltd. 27449.

Dyestuffs.—L. F. W. Lawes, and Lawes Bros., Ltd. 27435.

Desurfacing control systems.—Linde Air Products, Ltd. 27484-5.

Detecting organic halogen compound.—D. H. McLean, and P. N. Newton. 27643.

Discharging waste liquids.—Mint, Birmingham, Ltd., and W. E. White. 27632.

Treatment of metal surfaces.—Monochrome, Ltd., and S. C. Wilson. 27106.

Sodium sulphate products.—S. J. Mernard. 27757.

Mineral oil refining.—N.V. de Bataafsche Petroleum Mij. 27197.

Liquid distillation.—N.V. Vereenigde Stearine Kaarsenfabrieken Gouda-Apollo 27693.

Fluid base compositions.—Noned Corporation. 27455.

Carbon black.—Philips Petroleum Co. 27282.

Thioplasts.—Régie Nationale des Usines Renault. 27213.

Complex Carbides.—Régie Nationale des Usines Renault. 27345.

Thermoplastic materials.—Reliephographie, Soc. pour l'Exploitation des Procédés de Photographie en Relief M. Bonnet. 27306-7.

Extracting cellulose from vegetables.—J. Relier. 27289-90.

Wood filling composition. — Roxalin Flexible Finishes, Inc. 27691-2.

Fertilisers.—K. Schreiner, C. A. L. Lowry, W. B. Topp, and C. F. G. Kopsch. 27492.

Treatment of steel surfaces.—Soc. d'Electro-Chimie, d'Electro-Metallurgie, et des Aciéres Electriques d'Ugine. 27610.

Alkyl silicones.—Soc. des Usines Chimiques Rhône-Poulenc. 27598.

Hydraulic systems for aircraft.—Soc. d'Inventions Aéronautiques et Mécaniques S.I.A.M. (France, Jan. 7, 1942.) 27437.

Divinyl benzene.—Standard Telephones & Cables, Ltd. 27560-1.

Resinous compositions.—Stein, Hall, & Co., Inc. 27470, 27594.

Oil extractors.—C. M. Street, and Vokes, Ltd. 27476.

Centrifugal machines.—Sulzer Frères S.A. 27164.

Treatment of oil-bearing seeds.—W. W. Triggs. (V. D. Anderson Co.) 27581.

Sewage treating.—W. W. Triggs (Dorr Co.) 27690.

Aluminium, etc.—United Anodising, Ltd., and E. Shelton-Jones. 27606.

Glyoxaline derivatives.—Ward, Blenkinsop, & Co., Ltd., A. A. Goldberg, and L. P. Ellinger. 27427.

Solvent vapour application.—P. Wilderman. 27316.

Hard pitch, etc.—T. O. Wilton, and Chemical Engineering & Wiltons Patent Furnace Co., Ltd. 27111.

Complete Specifications Open to Public Inspection

Multicoloured synthetic gems and process for making same.—Linde Air Products Co. March 17, 1945. 5738/46.

Manufacture of chlorine dioxide.—Mathieson Alkali Works. March 12, 1945. 4685/46.

Chlorine dioxide.—Mathieson Alkali Works. March 16, 1945. 4687/46.

Purifiers for compressed air and gases.—Schweizerische Lokomotiv und Maschinefabrik. March 13, 1945. 7962/46.

Process for recovering alumina and a residue rich in iron out of bauxites and similar ores.—J. C. Séailles. April 28, 1943. 25660/46.

Hydrocarbon alkylation products.—Shell Development Co. Feb. 22, 1943. 2923/44.

Corrosion-inhibiting compositions.—Shell Development Co. March 13, 1945. 3529/46.

Method of fusing materials such as glass.—S.A. des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny et Cirey. Jan. 29, 1945. 25624/46.

Preparation of refractory and abrasive materials.—S.A. des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny et Cirey. March 19, 1942. 25625/46.

Making a water solution of raw aluminates of lime and its application to the manufacture of alumina.—Soc. des Ciments Français. June 14, 1941. 25661/46.

Alkaline washing agents.—Soc. des Produits Peroxydes. Jan. 15, 1942. 24687/46.

Washing agents.—Soc. des Produits Peroxydes. July 9, 1943. 24839/46.

Process for the manufacture of threads, etc., from polyvinyl chloride.—Soc. Rhodiaceta. May 5, 1942. 28221/45.

Solid dimer of alpha-methyl para-methyl styrene and methods of making same.—Standard Telephones & Cables, Ltd. March 13, 1945. 7322/46.

Hardening of wood.—Svenska Cellulosa A/B. March 15, 1945. 7988/46.

Softeners for rubbers.—United States Rubber Co. March 15, 1945. 899/46.

Resinous bonding or adhesive compositions.—Westinghouse Electric International Co. March 15, 1945. 4493/46.

Complete Specifications Accepted

Methods of consolidation of powdered metals.—British Thomson-Houston Co., Ltd. (General Electric Co.) Oct. 14, 1943. 580,490.

Preparation of catalytic masses for hydrocarbon synthesis.—K. M. Chakravarty. July 7, 1944. 580,612.

Preparation of polymerisable methacrylic esters and polymers and interpolymers thereof.—J. W. C. Crawford, R. H. Stanley, and I.C.I., Ltd. Aug. 8, 1944. 580,665.

Treatment of polymeric materials and the production of articles, especially flexible petrol-resistant articles, from the treated materials.—B. J. Habgood, D. A. Harper, R. J. W. Reynolds and I.C.I., Ltd. Oct. 14, 1941. 580,524.

Curing of polymeric materials.—D. A. Harper, H. P. W. Huggill, and I.C.I., Ltd. June 1, 1942. 580,526.

Treatment of petroleum cracking residues.—E. Hene. Aug. 31, 1944. 580,579.

Process for the manufacture of pantothenic acid and its salts.—F. Hoffman-La Roche & Co., A.G. Sept. 6, 1943. 580,509.

Purification and compression of ethylene.—E. Hunter and I.C.I., Ltd. Oct. 26, 1942. 580,185.

Sulphur-containing polymers.—I.C.I., Ltd. Sept. 22, 1943. 580,514.

Opacifiers for enamels.—G. H. McIntyre, and M. J. Bahnsen. Jan. 13, 1943. 580,530.

Apparatus for separating suspended particles from gaseous media.—P. May. July 7, 1944. 580,616.

Method for improving water-resistant characteristics of resins and resinous articles, and resinous products resulting therefrom.—Norton Grinding Wheel Co., Ltd. September 28, 1942. 580,537.

Granular soap product.—Proctor & Gamble Co. July 29, 1943. 580,627.

Stuffing boxes for rotary pumps for working fluids such as acids and lyes.—R. Rotheli. Feb. 5, 1943. 580,658.

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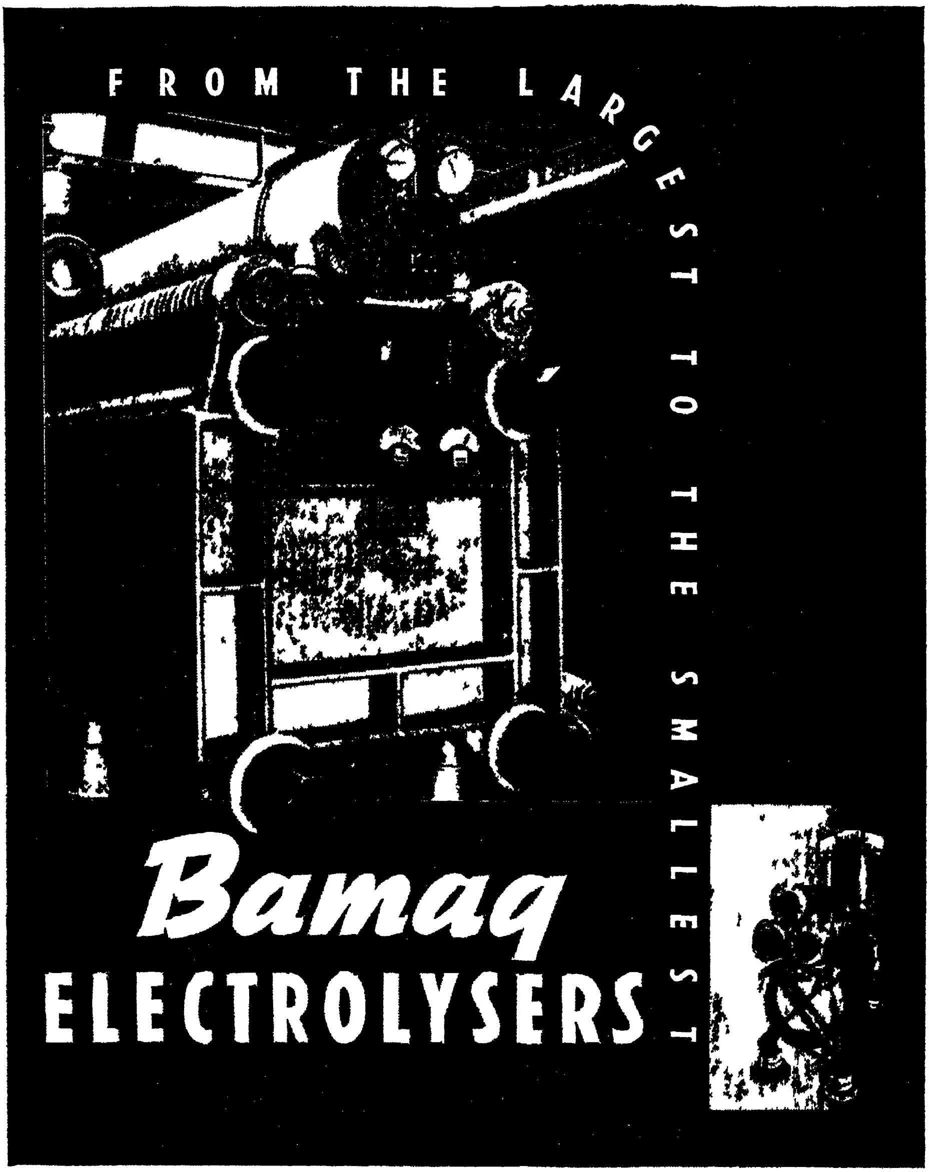
FROM THE LARGEST TO THE SMALLEST
Bamag
ELECTROLYSERS

Regeneration of spent catalysts.—Shell Development Co. May 31, 1943. 580,621.

Disazo- and polyazo-dyestuffs.—Soc. of Chemical Industry in Basle. Sept. 3. 1942. 580,486.

Manufacture of derivatives of sulphonated amines or sulphonated arylhydrazines.—Soc. of Chemical Industry in Basle. Dec. 24, 1941. 580,641.

Manufacture of vat dyestuffs.—Soc. of Chemical Industry in Basle. May 19, 1942. 580,642.

Turbine lubricating oil compositions.—Standard Oil Co. of California. April 13, 1943. 580,603.

Separation and concentration of diolefins.—Standard Oil Co. of California. July 22, 1942. 580,643.

Process for the separation of butadiene from alkylacetylenes.—Standard Oil Co. of California. Sept. 26, 1942. 580,644.

Preparation of materials for the production of photoconductive cells.—J. Starkiewicz and C. S. Wright. Feb. 25, 1944. 580,551.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Telegrams ALLANGAS FLEET LONDON Telephone: CENTRAL 3212 (12 lines

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1426. October 26, 1946 Annual Subscription 21s. Overseas 26s.

Fuel and the Future

THE great conference on the efficient use of fuel has ended its deliberations, and it is desirable to attempt some summing-up of its conclusions. It was the most widely attended conference that has ever been held on the subject. It was addressed by two Cabinet Ministers, and other high Government and industrial authorities. It is difficult to think of any aspect of the subject of fuel utilisation that was not covered. One's regret was that the exigencies of time made it necessary to hold so many meetings simultaneously that the industrialist or technologist interested in more than one aspect of the subject had perforce to choose which session he would attend. Many fuel experts of high reputation addressed the sessional meetings. In a sense this conference, coming so soon after the grant of a Royal Charter to the Institute of Fuel, may be said to have put the seal upon fuel technology as one of the premier industrial professions of the country. Fuel is necessary in every industry, from agriculture to steel production, from mining to the manufacture of textiles. Without it, the industries of the country would soon cease to operate. Upon fuel depends the position of this country as a Great Power. It is wise that we should take thought how to use our greatest natural raw material to the best advantage.

The Conference disclosed what many had known for some time, namely, that the prospects of there being adequate fuel for the coming winter are not bright. It seems that it is impossible to expect much more coal from the pits. Whether the miners as a body are working to maximum capacity or not, is not for us to say; the fact that production per man-shift is less than it was before the war may be due to many reasons. Absenteeism is certainly one of these, and as we explained in our issue of October 12, one important reason for that is the shortage of consumer goods and the elimination of any incentive to work harder. Good management can secure greater output per man-shift from a reduced labour force and thus offset shortage of labour. Good management, however, involves giving the workers the tools with which to produce more — in short, mechanisation. The mines cannot be mechanised overnight, and this necessary technical step is likely to take many years. Plainly, therefore, as a short-term policy, the only certain answer to shortage of fuel is economy in its use.

How much coal must the country save? Here we profess to be

On Other Pages

in some doubt. Mr. Shinwell changes his tune more often than any other Minister, and he has left doubts in the public mind more than once this year as to the reality of the crisis that is now upon us. He has told us in Parliamentary speeches that we are 5,000,000 tons of coal short of our yearly requirements. He told the Conference that an additional 100,000 tons of coal a week would enable the nation to get through the winter without major dislocation. But Sir Stafford Cripps at the same Conference pointed to the need for greatly increasing our production of all goods, both for home consumption and for export. "We cannot do that," he said, "unless we increase our efficiency. To increase our efficiency of production means more mechanisation, and this in turn means more fuel and power." Thus the production drive is likely to demand further coal, over and above the present deficit of 5,000,000 tons. An example comes from agriculture. It was pointed out that grass-drying is a method by which our present deficiencies of feeding-stuffs for livestock can be made good, and the production of grass increased. It was further indicated that the fresh grass, dried immediately on cutting, provides material for the chemical industry in the form of certain chemicals, as well as chlorophyll and colouring matter. The grass-drying programme has had to be severely cut for lack of fuel.

We want more coal than the Minister of Fuel and Power suggested, if the full programme of production is to be put into effect. "If we suffer a hold-up this winter due to shortage of fuel and power," said Sir Stafford Cripps, "it will have the gravest effect on our export trade, and therefore on the supply of consumer goods now coming forward." Mr. Shinwell, in opening the Conference, asked for a general saving in home and industry alike of 10 per cent. That would mean about 15,000,000 to 20,000,000 tons of coal a year. In our view that seems about the proper target—and there is no reason why it should not be achieved without loss of production if proper measures are taken.

How can that be achieved? There is a short-term policy and a long-term policy. The short-term policy was set forth by Dr. E. S. Grumell, Chairman of the Fuel Efficiency Committee. First, the system of fuel watchers put into effect during the war should be immediately resuscitated and considerably extended. That system needs good organisation and the enlistment of the interest and co-operation of everyone in the country. The housewife at home, the worker and the manager in the factory, must all bear their share and with a will. That will take care of careless wastage and when allied to technical skill will rectify the more insidious defects which are equally wasteful of fuel. The second measure should be an all-out drive to secure maximum combustion efficiency in shell boiler plants and other combustion equipment. There are no doubt other measures which skilled engineers can suggest in the light of their local conditions. Chemical engineers in particular, will find that this is work for which they are peculiarly well fitted.

What of the long-term policy? There, we must confess, we found the Conference a disappointment. The "long-term" policy proposed by the Ministry seems to consist of little but opportunism. Although in his opening speech Mr. Shinwell announced that he would "turn from the short-term prospects to the long-term, from the period of improvisation to that of planning," his plans appear to consist of nothing more than the general encouragement of fuel efficiency in operation and in the design of plant. He pointed with satisfaction to the improvements in those directions that have been made in many industries during the past 20 or 30 years and called for a continuation of that process. Mr. Oliver Lyle, himself a member of the Fuel Efficiency Committee, has pointed out in his paper "Inefficiency" that by proper utilisation of our fuel, something like 80,000,000 tons of coal could be saved annually. A general electrificaton of the railways, for example, would save 10,000,000 tons: proper planning of power production another 21,000,000; collieries could save 5,500 000; the iron and steel industry 2,000,000; the proper use of domestic fuel based on carbonisation could save 23,000,000; and other industries well over 11,000,000 tons. These savings will be brought about only by the conscious planning of our fuel-using industries on a major scale. It is a great task; but the prize is glittering. It may be that Mr. Lyle's estimate is exaggerated: but if the attainable savings in coal are only half those amounts, and if in addition this country can be made smokeless—what a truly enormous benefit in reduced costs would be conferred on industry and on the whole nation!

NOTES AND COMMENTS

Trade and Government

ALTHOUGH it does not say so in so many words, the latest manifesto of the Federation of British Industries, concerning the relation between Trade and Government, is actually an indictment of the Working Parties established by the President of the Board of Trade to review the working of certain trades. It is pointed out that the Working Parties were appointed at a time when conditions were abnormal, and, while they may be eminently suited to such conditions, it by no means follows that they offer the best form of machinery for dealing with the future problems of industry, which, we all hope, will gradually approach more closely to the normal. Some organised contact between Government and industry there must be, however; and the F.B.I. contends that the obvious and most suitable contact can be provided by the Trade Associations. It is emphasised that the proposals embodied in the present recommendations should not be taken to refer to labour questions; but it is pointed out that all the Working Party reports so far issued agree that in any future arrangements the Trade Unions concerned must be associated with management in the consideration of general questions affecting the well-being of an industry. The counterpart of the Trade Union, on the management side, it is now contended, should be the Trade Association, which should take the lead in "improving and adjusting the organisation, both technical and commercial, of the sections of industry concerned, to meet the circumstances of the post-war world."

Methods of Co-operation

SOME commentators have seen in these proposals an extension of the "closed-shop" principle; but it is necessary to be on one's guard here, and not be carried away by the fascination of a topical catchword. It does not appear to us that the present proposals will make it any more difficult than in the past for the non-member of a Trade Association to carry on his business—just as there are non-Union houses which have been able to survive in various industries, despite the growing influence of the Trade Unions. Nevertheless, these proposals do present a further inducement for the independent firm to join in with its Trade Association—a practice which, in our humble opinion, offers other advantages besides that of being able to negotiate on something like equal terms with a Government department. The F.B.I. document goes on to outline three main systems by which co-operation between Trade and Government might be effected: (a) direct contact; (b) an advisory council; and (c) a statutory industry board. The first has already been tried, and has worked well in many industries where mutual confidence is high, and we agree that there is no reason for change here.

Advisory Councils

WHEN, on the other hand, the Government feels that a wider source of information ought to be available, an advisory council might be appointed, partaking in some degree of the nature of the Working Parties, for instance in having an independent chairman—perhaps even the Minister himself, or a high official in his department--but differing from them in keeping within the bounds of the industry and the department concerned for its composition. The third alternative, the statutory industry board, should be employed only where internal differences make voluntary action impossible, or nearly so. Such bodies, we agree, should be created only in exceptional circumstances, and should never be forced on an unwilling industry, each board being the subject of a separate Bill in Parliament. The whole question is one which requires prolonged consideration, and whatever the final conclusion, the F.B.I. is to be thanked for bringing the question into the limelight.

Goodwill and Illwill

IN most business balance-sheets a goodwill entry will be found on the asset side. The real value of this is always the subject of doubt and discussion observes Sir Ernest Benn in an article in *Truth*, but the fact is that a precise value can seldom be placed upon the goodwill of a business. This serves to differentiate goodwill from every other type of asset and to emphasise its importance. Goodwill may be defined as the prospect of continuity, it is the measure of the satisfaction that may be expected to bring the customers back for more. The preservation of his goodwill is then the overriding

anxiety with every good business man, who always thinks less of the profit and benefit of the orders in hand than of the continuing profit to be expected if those orders are filled in such a way as to give the maximum of satisfaction to the customer. To-day some thousands of millions of trade is done by the Government. Not a pennyworth of goodwill attaches to a single sovereign's worth of it. Indeed, on the contrary, most of it produces a great deal of illwill in the minds of all the parties concerned. Bulk purchasing, like the black-out, was imposed on us by Hitler, but while we have been able to shake off the horrors of the latter, the blacking or blotting out of the natural commercial structure by bulk official sale and purchase has been continued and indeed intensified. The willing buyer and the willing seller, in the sense in which those terms were previously used, are now almost non-existent; nobody, whether in trade or in any other way, deals willingly with any government, for government by its nature is force.

Transactions by Force

WHEN one government buys from another government force is applied at both ends of the transaction; the seller government enforces its own terms upon its own producer and the buyer government imposes its own terms upon its own consumers. All the elements of prosperity and progress are absent from these synthetic transactions. Price is a political calculation having little, if anything, to do with reality, as for instance when an egg is bought for 3½d., sold for 2½d., and another 1d. spent on the doing of it. A genuine market price, indicating with accurate certainty the relative state of effective demand and available supply, is almost a thing of the past. Commodities are commandeered, and rationed at different figures in every market, commandeering having taken the place of buying, and rationing being the present-day substitute for selling. In the result, the Canadian farmer is labouring under a sense of grievance, New Zealand is disgruntled because we pay more elsewhere, Argentina goes on strike at our terms, and the French prohibit the delivery of produce which would flow to us at a natural market quotation. In every country and in many trades minimum wages and maximum prices, both prescribed for political reasons, fail to fit, are liable to arbitrary alteration, and discourage or destroy both enterprise and employment.

The New Utilitarianism

QUALITY has ceased to be of the importance once attaching to it, and here is perhaps the most serious count in the indictment of government trading. Nothing is as good as it was. Coal, cheese, butter, bacon, mineral water, are the elementary samples of the new utilitarianism which is rapidly robbing most of the amenities of their appetising attributes. The humblest of housewives, who used to choose a chop to suit the taste of her man, is now reduced to 1s. 2d. worth of unclassified "meat," and everything is in like case, for goodwill and quality are close relations. Some of these descents from decency are due to scarcity, but others are directly due to the replacement of the tradesman by the official. Instead of Freedom from Fear as promised by the Atlantic Charter, deep-rooted fear is now the prevailing sentiment in the breasts of all those on whom the economic well-being of mankind has hitherto depended. And that fear is best defined in the language of commerce as the absence of goodwill. Sir Ernest assures his readers that the present aim is to establish Government trading on a permanent basis. Along that way, he says, lies disaster; recovery will only occur in so far as this policy is reversed and genuine markets opened.

Zinc Phosphide

Poisons Act Amendments

AMENDMENTS to the Poisons List and Poisons Rules (Pharmacy and Poisons Act, 1933), coming into effect on October 15 (S. R. & O. 1946, Nos. 1625, 1626), are as follows: to Part I of the Poisons List are added dihydrodesoxymorphine, and pethidine and its salts; and to Part II of the List is added zinc phosphide.

In the Poisons Rules, dihydrodesoxymorphine, pethidine and its salts, and zinc phosphide are added to the First Schedule; but "articles containing zinc phosphide and prepared for the destruction of rats and mice" are exempted from First Schedule requirements by an amendment to Rule 10. Zinc phosphide is also included in the Fifth Schedule with an entry which permits listed sellers of Part II poisons to sell the poison *only* in the form of preparations for the destruction of rodents.

Phenols from Ammoniacal Liquor

Description of Plant for their Removal

A PAPER entitled "The Removal of Phenols from Gas Works Ammoniacal Liquor," by D. G. Murdoch, B.Sc., A.R.I.C., A.C.G.F.C., A.M.I.Chem.E., and M. Cuckney, B.Sc., A.R.I.C., was read by Mr. Murdoch at a meeting of the Institution of Chemical Engineers at Burlington House, Piccadilly, London, W.1, on October 8.

The paper included a description of a full-scale plant, as follows: Gas liquor, after settling and separating from tar in three storage wells (total capacity 1,000,000 gal.), is pumped therefrom by an electrically-driven, horizontal reciprocating pump through a 9-in. C.I. main to the dephenolation plant. Each pump is capable of delivering 20,000 gal. gas liquor per hour at a pressure of 25 lb./sq. in.

The gas liquor passes to four tubular preheaters in series, where its temperature is raised to 20-25° C. by means of low-pressure exhaust steam. Experience has shown that this temperature is desirable to obtain good separation of wash oil and gas liquor; the use of higher temperatures induces loss of wash oil by increased solubility in the gas liquor. The condensed steam from the jackets passes through a seal pipe to a 500 gal. storage tank on the ground floor, and serves as a water supply for No. 1 stage, as well as for the preparation of fresh caustic soda liquor if this is required. The preheated gas liquor passes through two tar separators charged with coke nuts (shown in Fig. 1), on which any tarry particles are deposited, thence *via* a twin strainer to an overhead balance tank. Provision has been made for by-passing the preheaters and tar separators, as well as the dephenolation plant, if necessary.

Turbidity Detector

A selenium cell for the detection of turbid or tarry gas liquor is located on the inlet gas liquor main just before the preheaters. A gentle stream of gas liquor passes through a glass-sided container, which is illuminated by a 100-watt lamp suitably housed. The turbidity of the liquor affects the amount of light passing through the liquor on to the selenium cell, and causes a red warning lamp on the control panel to light up when the gas liquor is turbid. A similar unit has been fixed on the washed gas liquor stream leaving the plant to detect suspended oil particles if the separation is not satisfactory.

The tar separators consist of two mild steel cylindrical vessels, of 6 ft. 6 in. dia. and 17 ft. 3 in. over-all height, each with conical bottom and domed cover provided with safety valve, pressure gauge and vent pipe; the normal working pressure is 15-25 lb. per sq. in. Each separator is charged with 4 tons 2-in. to 3-in. furnace coke to fill the lower 7 ft. 6 in. depth, and 3 tons of 1-in. to 2-in. coke to fill the upper 5 ft. The coke rests on a perforated metal grid. The gas liquor enters near the bottom, passes up through the coke layer, and leaves near the top. Tarry material deposited on the surface of the coke gradually falls to the conical base, and is run off periodically. When the coke becomes fouled with tar, provision is made to by-pass each separator. The gas liquor is run out to the well, and open steam is then passed into the base of the separator to warm the coke and facilitate the removal from its surface of adhering tar, which collects at the base and is run off to storage. Finally, the steam is shut off, and, after a period of cooling, the separator is recharged with gas liquor and put into the circuit again.

Removable Filters

A twin strainer is situated at the outlet of No. 2 tar separator, and contains two perforated metal filters, which are removable for cleaning. The gas liquor flow can be diverted by means of valves so that one of the filters can be removed without stopping the flow through the other. The filter traps any small pieces of coke carrier forward in the gas liquor leaving the tar separators. The gas liquor, now preheated to 20-25° C., and substantially free from tarry matter, passes to a mild steel overhead balance tank of 1060 gal. capacity, provided with a 6-in. ball valve on the inlet this valve has a stainless steel seating. From here the gas liquor flows by gravity at constant head to the washers, entering at No. 10 mixer.

The washing plant consists of the following ten pairs of mixers and corresponding separators: No. 1 stage, charged wash oil and water; Nos. 2, 3 and 4 stages, wash oil and revived soda; Nos. 5-9 stages, gas liquor and wash oil; No. 10 stage, gas liquor detarring by oil in closed circuit.

The mixers are cast-iron cylindrical vessels, each of 800-gal. capacity, 4 ft. 3 in. internal diameter by 8 ft. deep by 1½ in. thick. There are flanged branches of 14-in., 12-in., 9-in., and 6-in. bore on each mixer, and a 2-in. bottom outlet. Each cover (1¼ in. thick) has a 6-in. diameter dip hole and cover with gas seal, and an 18-in. hole to receive the agitator steady bracket and bearing. The agitator in each mixer consists of a steel vertical shaft, 2¼ in. diameter, offset 9 in. from centre of vessel, fitted with ¾-in. thick diamond-shaped agitator blades, welded to the shaft, surmounted by

a 12-in. diameter by ½-in. thick anti-vortex disc immediately above the top blade. The shaft extends 5 ft. 6 in. above the top of mixer, and is supported by a C.I. steady bracket with ball thrust and ball bearing. The shaft has a lower ball bearing carried between two sections of the steady bracket about 18 in. above the top of the mixer, and is fitted with a cup form of gas seal placed on top of the cover. The gearing consists of a C.I. machine cut bevel wheel and a "Fabroil" bevel pinion—ratio 2 : 1, with hunting tooth. The agitator driving shaft, 3 in. diameter, is carried in roller-bearing plummer blocks mounted upon stools welded to the tops of the separators, and is disposed centrally between the two rows of mixers; it is driven by V belt from a 20-h.p. motor. All the bearings are lubricated by the "Tecalemit" pressure system. All valves between the mixers and the separators regulating the flow are of iron, double flanged.

The separators are ten ⅜-in. mild steel vessels, Nos. 1-4 being 8 ft. 6 in. diameter by 18 ft. long, with flat ends, and 8000 gal. capacity, and Nos. 5-10, 9 ft. diameter by 18 ft. long, and 9000 gal. capacity. Each vessel is fitted with an 18-in. raised manhole with cover, gauge glass, and the necessary 14 in., 12-in., and 9-in. flanged connections. The separators and mixers are supported on a mild steel structure at approximately

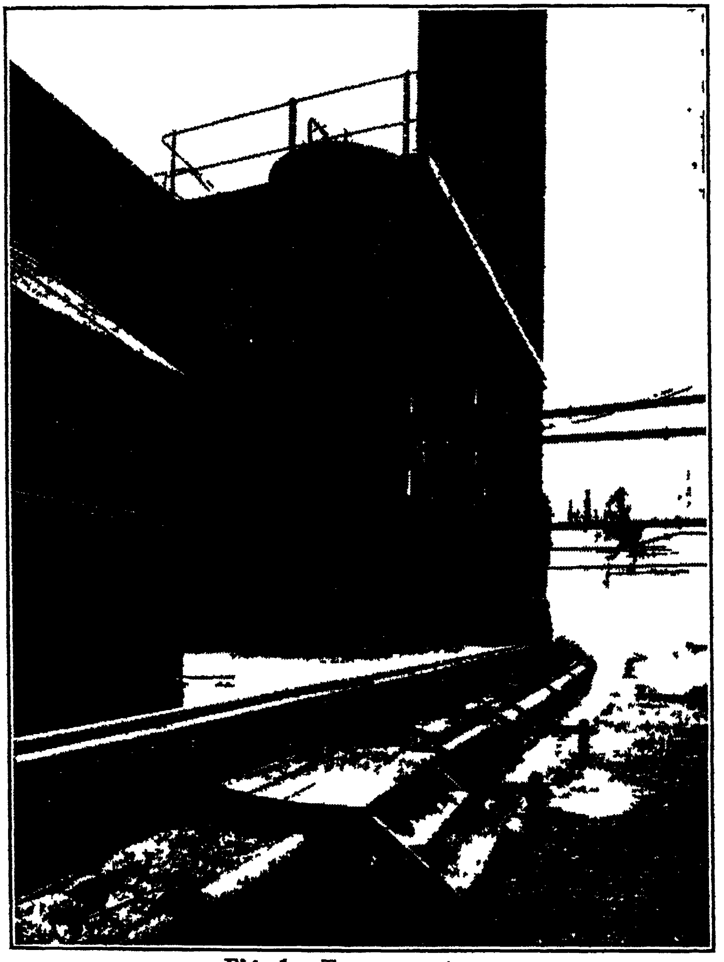

Fig. 1. Tar separators.

9 ft. 3 in. above ground, and a gangway with grill flooring is fitted around the rectangle enclosing the tanks at 13 ft. 6 in. above ground level.

All the separators, except Nos. 2-4 in the

caustic soda wash oil section, are provided with skimming gear to separate any intermediate layer that forms at the interface between the gas liquor and wash oil layers. This consists of two slotted pipes mounted on hollow vertical spindles, capable of rotation horizontally inside the separator, and provided with means of being raised or lowered a total distance of 1 ft. The intermediate layer is run off slowly to a storage tank while the arms are being rotated, and this operation can be carried out without stopping the normal dephenolation process. The separated sludge is allowed to separate in the storage tank into an upper oil layer and a lower gas liquor layer, which are returned to the process. As the dephenolation plant has been run at a very uniform temperature of 20-25°C., with exclusion of air as much as possible, the amount of intermediate layer formed has not been so much as was anticipated from the experimental plant performance.

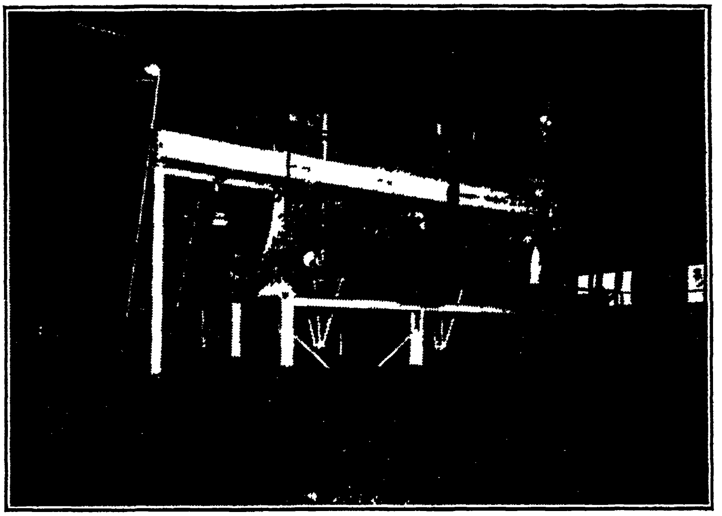

Fig. 2. General view of the plant, showing the skimming gear.

The gas liquor enters at the bottom of No. 10 mixer, where it is washed with a suitable oil in closed circuit to remove any traces of tar passing through the coke filters before it enters Nos. 9-5 sections, where it is dephenolated by counter-current washing with wash oil. The washed gas liquor passes out from No. 5 separator through an adjustable weir to a storage vessel of 9000 gal. capacity, from which it is pumped to the sulphate of ammonia plant. Wash oil, leaving No. 9 separator and charged with phenols extracted from the gas liquor, passes through a weir to a storage vessel of 5000 gal. capacity, from which it is pumped through a preheater to an overhead balance tank of 580 gallons capacity fitted with a 3-in. ball-valve. The wash oil flows by gravity to No. 1 mixer, where it is washed with 1 per cent. by volume of water to remove ammonia, H_2S, etc., and then passes Nos. 2-3 sections, where it is treated with revived soda and is finally washed substantially free from phenols in No. 4 section by a further quantity of revived soda, or, if necessary, with fresh soda liquor prepared from solid caustic soda and condensed steam. The wash oil containing not more than 0.05 per cent. phenols passes *via* a box weir to Nos. 5-9 sections, where it serves to extract the phenols from further batches of gas liquor, and overflows from the weir on No. 9 separator to the wash oil storage vessel.

Revived caustic soda is received from the causticising plant and collects in a storage vessel (8000 gal. capacity), from which it is elevated to a balance tank of 225 gal. capacity and flows by gravity to No. 4 mixer. The soda liquor becomes charged with phenols during the passage through Nos. 4, 3, and 2 sections in contact with the used wash oil, and the sodium carbonate liquor produced, containing 10 per cent. by volume of phenols, overflows from No. 2 separator through an adjustable weir to the storage vessel. From here it is pumped to the crude carbolic plant for the isolation of the crude phenols by carbonisation, and the sodium carbonate liquor produced is causticised with lime to regenerate revived soda liquor which is returned for use in the dephenolation plant.

Fresh caustic soda liquor is prepared when required by dissolving caustic soda direct from drums by sprays of water. The drum of caustic soda is hoisted up and placed in position on rollers in a chamber above the dissolving tank. A hole in the side of the drum, about 9 in. square, is cut

with chisel and hammer. This exposed portion of the soda is placed above the sprays, the cover of the chamber is closed, and water or dilute soda liquor is circulated by a pump and the spray regulated to impinge on the soda in the drum. As the caustic soda dissolves, the spray is increased to reach the remainder of the contents of the drum. One drum (750 lb.) of caustic soda is dissolved in about four hours, and yields 1340 gal. of 5 per cent. solution.

If the supply of revived soda from the carbolic plant is for any reason inadequate, fresh soda liquor is elevated to an overhead tank of 500-gal. capacity, and flows by gravity to No. 4 mixer for final washing of the wash oil, passes into No. 4 separator and joins the revived soda liquor delivered to No. 3 mixer. Water from an overhead tank of 500-gal. capacity flows by gravity to No. 1 mixer, where it serves to remove ammonia and H_2S from charged wash oil, and the aqueous extract overflows from No. 1 separator through a weir to the gas liquor well.

By adjustment of the height of the outlet weirs and the regulation of the valves on the circulation pipes between each mixer and its corresponding separator, the proportion of wash oil and gas liquor or soda liquor in each mixer may be kept at the desired ratio. On a central control panel are mounted the Kent's meters that record the rates of flow of the various liquors and wash oil flowing by gravity from the overhead balance tanks to the washers. Those for gas liquor and wash oil are of the recording and integrating type.

A flow indicator is provided to give the rate at which the dephenolated liquor is being pumped to the sulphate plant, and a Duplex flow controller enables the inlet gas liquor rate to the washers to be controlled automatically by the rate of washed gas liquor being pumped away, by means of electrical contacts which operate a motorised valve on the inlet gas liquor pipe to the washers. The temperatures of gas liquor and wash oil are registered on a Cambridge recorder, and a six-point indicator is provided to give the temperatures at various points in the washing process.

Recruitment for Foundries

Industry Needs 20,000 Men

A RECRUITING campaign to enlist 20,000 workers for British iron foundries is to be opened on November 1, announced Mr. William Leonard, Joint Parliamentary Secretary to the Ministry of Supply, during a visit to a foundry at Bolton, Lancs. The campaign will be run by the Ministry of Supply in co-operation with the Ministry of Labour and the Central Office of Information, and will be concentrated at first on obtaining 10,000 men for light castings for the housing programme. Unskilled workers between the ages of 16 and 45 are mainly needed. Methods to be used to get these men will be by booklets, films, broadcasts, posters and displays, and loudspeaker vans.

The shortage of labour in iron foundries is one of the bottlenecks restricting national production. Output to-day is 800,000 tons less than the pre-war figure of 3,300,000 tons.

Stud Welding

New Method Avoids Drilling

THE Nelson Electric Arc Stud Welding process, which is to be sponsored in this country by Cooke & Ferguson, Ltd., of Manchester, is a means of welding studs automatically and directly on to metal surfaces with complete fusion, without the necessity for drilling, tapping, or hand welding.

In use, the operator loads the stud in the appropriate chuck, and slips a ferrule, which is gripped by steel fingers, over the stud. The pointed end of the stud is positoned on the parent metal surface, and pressure is maintained against a spring which is loaded into the hand-tool, until the ferrule bears against the surface of the plate. On pressing the trigger button, the weld cycle takes place. No welding experience is necessary as the cycle is completely automatic after the control timing device has been set for the appropriate diameter of stud.

When the stud makes contact with base metal, a current flows through the complete circuit and is indicated visually by a small neon tube on the tool. The small current thus indicated is sufficient to burn through a layer of paint, red-lead, rust, or light scale.

The studs incorporate a patented method of loading which guarantees a sufficient amount of flux in each stud. This flux cannot be chipped off by handling previous to welding; it also allows more flux to be used than can be deposited by any other method. No separate a.c. supply for the control box is necessary. All relays, etc., work from the welding generator d.c. output.

The U.S. Department of Commerce recently set up an Office of Technical Services (O.T.S.) with the following five divisions: Inventions and Engineering; Industrial Research and Development; Technical Advisory Service; Bibliographic and Reference; Technical Industrial Intelligence.

Fuel Economy in Chemical Works*

Its Relation to Other Factors in Design

by B. E. A. VIGERS†

A HUNDRED years ago when this country was the leader of industrial development, it probably owed that position to three major assets. First, the enterprise and inventiveness of its industrial adventurers, second, the capacity of its artisan population for hard work and the acquirement of manual skill, and third, the possession of easily worked seams of high-quality coal. At that period there were also significant home reserves of other raw materials such as iron, tin, and lead ores, as well as agricultural products such as wool and timber. As time went on and industry developed, the indigenous supplies of these secondary materials became inadequate, but the enterprises which were established by British people overseas and the exports of services and manufactured products made possible the importation of all the many raw materials which were required for the continued maintenance and development of a great industrial population on an island, itself too small to provide even the food which that population required.

Reduced Assets

The changes brought about since 1914 have largely stripped the country of those assets which ensured the ability to purchase requirements from abroad, and the problem which has to be solved is that of the need to rebuild purchasing power in face of competition from many countries, which not only have their own supplies of raw materials, but which have themselves become highly industrialised and in many cases have sources of cheap power which are denied to this country.

The chemical industry, being largely concerned with the conversion of the products of nature to the raw materials of other industries, is acutely concerned in this situation, and to those who are employed in the design and operation of chemical works falls the duty of scheming to economise in those resources which are in short supply and costly, by making the maximum use of those which are cheaper and more readily available. In order to do this successfully, it is necessary to consider again, in the light of present circumstances, to what extent the three major assets are still available.

It is evident that coal is becoming scarcer, dearer, and of poorer quality. With an ageing population and shorter working hours, labour is becoming scarcer, and with the cyclic process of wage increases, it is becoming ever dearer.

Cheaper Technical Skill

Technical and management skill is the only commodity which is becoming relatively cheaper, since salaries do not rise in the same proportion as wages and prices. Unfortunately, just at a time when there is the greatest need for the technical ability and experience of the younger people, many of them have had their training interrupted by the war, and there is therefore a shortage in this respect also. On the credit side may be reckoned the experience of organising and dealing with their fellow men which many have gained in the Services. It is now doubly important that those who remained in industry should apply themselves to helping those others who are returning to it, to make the biggest contribution of which they are capable. It is only by great improvements in technique and management that there is any hope of making good the deficiencies in other directions.

A paper on the design of chemical works cannot ignore the fact that its subject involves a complex function of interrelated variables of which fuel economy is only one, and one which cannot be properly studied unless in relation to the others. The main factors which should be considered may be listed as follows:

(a) The requirements and limitations of the process which is to be operated.

(b) The economy of energy in all its forms.

(c) The economy of water for cooling and process purposes.

(d) Economy in handling materials.

(e) The economy of labour, skilled and unskilled.

(f) The economy of capital, management and supervision.

The central thesis of this paper is to emphasise that in the design of works, unless due consideration and weight is given to all these factors from the outset, the greatest over-all economy will not be achieved. In too many cases, the lay-out of a factory is determined on purely process considerations alone, the other points being regarded as services only, to be fitted in as well as may be, at a later date. It is sometimes said that because the business of a company is the manufacture of certain products in which

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* From a paper presented at the conference on "Fuel and the Future" held at the Central Hall, London, S.W.1, on October 8-10 (Section E, Session III, organised by A.B.C.M.).

† Of B. Laporte, Ltd., Luton.

the services do not appear as a major item of cost, these services should be kept as simple as possible instead of striving after the highest economy; but although simplicity is always attractive, it can be misleading. The intention is not to belittle simplicity as such: if two solutions of a problem achieve the desired end, equally successfully in all respects, then the simpler solution is the better, but the aim of this paper is rather to invite further consideration from those responsible for the design of the works who, for example, prefer to instal low-pressure boiler plant for process steam, and to buy all their power from the supply authorities on the grounds that any economy attained by combined generation is not worth the extra complication and maintenance involved. Such a view may be correct in some few instances, but it should not be so in general if enough attention is given to design, and if care is taken to conform to the principles dealt with in this paper.

In view of the foreseeable prospects facing the industries of this country, it is maintained that if the savings of a fuel economy scheme, such as that of the combined generation of heat and power, can be reliably shown to cover all its costs, howsoever arising, even though with little profit to the undertaking concerned, it should be adopted as a matter of national duty in order to save the coal which would otherwise have been consumed at the power supply authorities' generating station. The engineer and management should be prepared to accept the extra responsibility which may be involved as a contribution to national economy and an aid to the continued operation of industry.

Mutual Benefit

By the same token, an undertaking which does make such a contribution is surely entitled to consideration from the authorities who are responsible for the allocation of fuel. In the example quoted there will be a saving of an amount of fuel at the supply authorities' power station, but a fraction of this amount will be required to be burnt under the boilers of the factory in addition to that which would be required for low-pressure heating steam alone. This fact should be recognised, and the fuel should be made available. The power supply authority should also play its part and be more ready than is often the case to allow paralleling of factory generating plants on their mains, if the necessary protective gear is provided.

Chemical works vary so widely in their requirements that it is quite impossible in this paper to cover individual cases. Moreover, most managements have to deal with works which have grown up over a period of years, often resulting in the boiler house being remote from the centre of gravity of the load. In such cases, there may be long distances for the conveyance of low-pressure steam, and for the return of condensate. Material-handling problems may be so scattered that it is difficult to devise economical methods of dealing with them. It is therefore proposed to consider the interrelation of the various factors in the design of new works only, but with the hope that some of the points raised may also prove fruitful in the modernisation of old works.

Balance of Factors

It is not to be expected that the requirements of all the factors can be met to perfection. Some will have to be sacrificed in some measure in the interests of the others, but as has been said before, the best all-round result can only be attained if all are given consideration from the outset. Each will be dealt with in turn, and attention will be drawn to the points at which each impinges on the others.

If the principle is accepted that the designer of a process works is in duty bound to try to achieve the greatest possible economy in fuel, he must, at all times, pay close attention to the thermodynamic criterion that, whenever energy must be degraded, the maximum benefit resulting from the process must be striven for. Heat should be taken into the process at the highest practicable temperature; thereafter, it should be used with progressively falling temperatures with the minimum of irreversible processes, and should finally be rejected at as low a temperature as may be.

A very common breach of this rule is the use of direct firing for drying processes, which could equally well be effected by means of low-grade heat, either in the form of waste gases from furnaces which have to be operated at high temperature, or more commonly by exhaust steam from engines. In both of the latter cases, the heat which is produced at high temperature by burning fuel is first used to peform a useful function before passing on, with little loss of capacity, to evaporate moisture in the dryer.

In processes which involve high-temperature furnacing operations, the temperature required by the latter will usually dictate the conditions of the first use of the heat. It should be universally accepted that, wherever possible, the waste heat from such furnaces should be recovered in regenerators or recuperators, and the waste gases then passed to waste heat boilers or other means of heat recovery.

Electrical furnacing operations are a special case, in that the power supply, if obtained from thermal stations, has already passed through the process of conversion from heat to power. Except in such cases as the reduction of alumina to aluminium, where electric energy is used electrolytically as well as in the production of heat, or the

case of operations at extremely high temperatures, which could not be easily attained by other means, the use of such high-grade energy as electric power for heating should be justified only by very special process conditions or by exceptional economy of some other commodity such as labour or capital.

Steam Heat

In most processes where the major part of the heat required is not employed in high-temperature furnaces, the usual method of application of heat is by means of steam. Applying the thermodynamic criterion, the steam should be generated at the highest practicable pressure and temperature. It should be first used for the generation of power in steam engines or turbines and exhausted at the lowest permissible temperature and pressure for process uses. The practical limit for the inlet temperature and pressure will be determined by the considerations of the size of plant involved and of capital, labour and management. Small engines and turbines are not available for very high pressure, owing to clearance losses, etc. A higher grade of management and operative labour is required for the successful operation of high-pressure plant, and. while justified for a large output, the extra cost of such supervision would nullify the gain on a smaller installation. Questions of the quality of water available as boiler feed, and the amount of condensate which could be returned to the boilers also have a bearing on this subject.

High-pressure plant is, of course, more costly than low-pressure equipment of the same capacity, and if it is considered that availability is adversely affected, more provision must be made for stand-by, since over-all reliability in maintenance of output is usually of prime importance. For these reasons, high pressure usually involves high capital charges, but so long as all the foregoing factors are carefully assessed, the aim of the designer should be to adopt conditions for the maximum generation of power.

It is not easy to determine the lowest pressure at which the steam can be exhausted. The stated requirements for process use should be subjected to close scrutiny. In a great number of cases, such figures are based on heat-transfer requirements, and an examination should be made into the possibility of reducing the required temperature and pressure by increase of the area of heat-transfer surfaces.

In chemical processes advance in this direction is sometimes restrained by the need for special and costly corrosion-resisting materials in the construction of such surfaces. The point is, however, so important that investigation should be made of the possibility of modifying the process to remove the difficulty. For example, film coefficient may be improved by reducing the viscosity of a liquor or by increasing its velocity; or again, it may be possible to avoid a difficult evaporation of an acid liquor by carrying out the necessary concentration at another stage of the process where the liquor is neutral. An alternative method of attack may be to supply the major portion of the heat required in a process by means of low-pressure steam, and thereafter to use a small quantity at a higher pressure in order to attain the final temperature which is required. Such methods of "stage heating" are good examples of the thermodynamic approach to heat economy problems, and the regenerative feed heating methods which are adopted in high-efficiency power stations would repay study by those who are not familiar with them.

Apart from the limitations of process requirements, the capital cost and heat loss from large mains may be a deciding factor, and this is one of the most important aspects from which the lay-out of the works should be considered in relation to fuel economy. A difficult case is that in which, while a majority of the factory requirements can be met at a low pressure, a certain amount of steam must be supplied at an intermediate pressure. In such cases, it is necessary to consider whether it is most economical (a) to raise the back pressure of the whole steam output to meet the higher requirements, (b) to degrade the necessary quantity of high-pressure steam to the intermediate pressure without recovery of power, or (c) to employ a pass-out machine to provide the necessary intermediate supply. The correct solution can be determined only by detailed investigation of the over-all economics of each method.

Loss through Evaporation

While the principal gain accruing to the use of process steam at a low pressure is that more power may be generated per lb. of steam used, there is an additional reason for keeping the pressure as low as possible. When the condensate is drained through traps from any appliance operating at above atmospheric pressure, the sensible heat above 100°C. will cause a proportion of the condensate to evaporate as flash steam, and this, if allowed to escape to atmosphere, represents an important loss. If the working pressure is low, this loss is minimised and the need for complicated arrangements for its recovery may be avoided. If, however, the pressure must be high, it is most important that steps should be taken for such recovery, usually by allowing the condensate to flash in one or more stages into appropriate lower-pressure users. If such an arrangement must be adopted, it will be facilitated if early consideration has been given to the lay-out of the plant so that

successive users of the steam are conveniently adjacent to one another.

The grouping of plant in a factory in such a way that heat exhausted from one process either as steam or waste gases may be passed on efficiently to other users is a similar problem to that of handling materials through the factory, but it is often lost sight of. The ideal arrangement is that the boiler house should be at the centre of gravity of the load. The engine house will normally be built alongside the boiler house, and it is desirable that big users of low-pressure steam should be situated near by in order to reduce the captal cost and heat losses of the low-pressure mains. Users which must be supplied with high-pressure steam may be situated at a greater distance, since the steam mains for the conveyance of a given quantity of steam at high pressure will be smaller than those required for low pressure, and pressure drop in the high-pressure mains is less important. Exhaust steam from the high-pressure users should be discharged to an efficient flash system and returned *via* intermediate or low-pressure users towards the boiler house.

It is sometimes said that pressure drop in steam mains is of little importance since in itself it causes no loss of heat, and little fall in temperature. To take such a view is to sin aganst the second law, since the loss of pressure implies an increase of entropy and it is evident that anyone who maintains this view is thinking only in terms of the economy of heat and is taking no account of energy potential. The loss would be evident if all endeavours were beng made to achieve the lowest possible back-pressure on a steam engine or turbine. If no engine is installed, schemes ought to be in hand to put one in.

Economic Continuous Process

Heavy peak loads are among the most serious offenders against economy whether it be for steam, power, or even water. As against an equivalent steady load, capital is increased by the need for bigger boilers, engines, mains, valves, switchgear, etc. Peak loads upset the efficient working of boilers and engines, and usually additional labour and more careful management is required if waste is to be avoided. For these reasons, there is general preference for continuous rather than batch processes if equally good results in every respect can be attained.

It is sometimes possible, with great advantage, to convert existing batch processes to continuous operation. For example, large batch evaporators may cause very heavy peaks, particularly if started up on cold liquor; but it is often possible to change over to continuous working even with corrosive or crystallising liquors by suitable arrangement of feed and extraction pumps, and good control of steam and temperature, which may be automatic. If batch working cannot be avoided, the aim should be to take the maximum advantage of diversity by arranging that no two user units go on the line at the same time. This can be more easily achieved if the factory lay-out is such that all these users, even though their functions be diverse, can be kept under the control, or at least the supervision, of one man. So far as is consistent with other economic or process requirements, the size of the units may be arranged to approximate to a continuous process as regards their service demands.

Steam Accumulation

Where steam peaks of big amplitude cannot be avoided, but are of short duration, the steam accumulator may be the correct tool to use. The capital cost of boiler-plant installation may be reduced and the practical economy of steam raising improved by smoother working, but the capital cost of the accumulator itself is high, and its operation is based on the unsound practice of degrading energy, since the potential of the steam is lowered irreversibly without the benefit of producing power. The pass-out engine or turbine avoids the latter disadvantage, and may help to level out the load on boilers when steam load fluctuations are of longer duration and moderate amplitude. Their use is particularly appropriate where there is a constant power load.

From the point of view of power and heat balance, process works can generally be divided into three groups: (1) those in which the heat required for process use can just be made to generate the amount of electrical or mechanical power which is required; (2) those in which the heat requirements are in excess of the amount needed for power purposes; and (3) those in which the power requirements cannot be met by utilising the process heat through the highest practicable temperature range in a heat engine. The balanced factory is the ideal, but it can only rarely be achieved, and it is generally found that the balance tends to become upset. The reasons for this are that advances in heat economy are usually greater than those of power, and measures taken to economise labour usually involve increased use of power, so that requirements for the latter tend to predominate.

Where the amount of power required is less than could be generated from the heat requirements by means of efficient plant, it is obvious that the first step is to adopt every possible means of heat economy. If, after this has been done, the heat requirements are still in excess, this fact should be no excuse for not generating every available kW of power. The excess energy may be made use of in a variety of ways. It may be possible to instal an ancillary process offering a profitable use, *e.g.*, an electro-

lytic process. It may be possible to arrange to supply a neighbouring works, to the mutual advantage of both parties.

The most logical way of disposing of sur plus power is to to deliver it into the supply authorities' mains. This is not usually permitted, or at best, no credit is given. This is a national calamity. Such export of power should be encouraged wherever it is possible, even in the case of small capacities, and full credit should be given for it, either as a money payment, or at least as a valuable offset against the cost of stand-by capacity provided by the supply authority.

Heat Pumps

When a factory presents an unbalanced condition of this type, it may be well worth while considering the use of vapour recompression or other form of heat pump. The suitable case would be one in which a very large quantity of heat is required at a low temperature. In such a case, less than the total heat requirement would be generated in the boiler plant as high-pressure steam. This steam would be used to drive an engine or turbine and exhausted to provide part of the process heat requirement. The power of the engine would be used to drive the compressor of the heat pump taking heat from the warmest available source and raising its temperature sufficiently to provide the remainder of the heat requirement. The amount of heat so pumped depends on the relation of the temperature of use to that of the heat source, but may be several times that of the heat extracted from the original steam by the engine.

Vapour recompression evaporators using rotary or steam jet compressors, a type of heat pump in fairly common use, are likely to be high in capital cost and call for high quality management and maintenance, but they should not be ruled out without adequate investigation. It will certainly be necessary to design the process and the heat transfer arrangements to use the heat at the lowest possible temperature in order to obtain the highest possible coefficient of performance.

Back Pressure Operation

The third case is that of the factory which requires more power than can be generated from the heat which is needed. Here the first problem is to decide how much power can be produced from back pressure or pass-out machines working between the highest and lowest temperatures and pressure which can be justified. The selection of these figures has already been discussed. The next question is how the balance of the power is to be obtained. It may be done by increasing the condensing capacity of the pass-out sets or by installing additional condensing machines. It must, however, be remembered that while back-pressure operation, with profitable use of the exhaust steam, offers efficiencies with which no condensing station can compete, as soon as condensers are employed, the plant is in direct competition with the central station, and unless it is on a very large scale, it is not likely to show to advantage.

The best all-round fuel economy will normally be obtained by generating as much power as the process steam will produce in a straight back-pressure machine, and by taking the balance of the power requirements from the supply mains. The generator of the back-pressure machine should be paralleled with the incoming supply, and the set should be governed to maintain constant pressure in the back-pressure mains. This arrangement will ensure that every lb. of process steam will generate its quota of power, except that, with an extremely peaky steam demand, it may be in the interests of capital and running economy to by-pass the highest peaks of short duration through a reducing valve.

Stand-by Power

The usual cause of the frustration of such schemes for national fuel economy is the refusal of the supply authority to permit parallel running, or alternatively, the price demanded for stand-by capacity is so excessive that the arrangement is put out of court on economic grounds. The obvious alternative is to instal stand-by capacity in the factory, but in the case of small and moderate-sized plants, this is not the most reasonable solution, if a broad view is to be taken of the national economy of capital equipment. In determining the price which should be paid for stand-by capacity, the chief engineer of a municipal supply department once stated that he must make a charge high enough to pay for installing and maintaining additional cables, switchgear, generators, and boilers capable of providing the specified capacity at all times. Such an attitude is disingenuous. Any chief engineer of a supply authority knows the value of diversity, and should give credit for it in this respect as much as in any other.

If a factory requires a really large supply of electrical power together with a moderate quantity of steam, both at a high load factor, there should be a first-class case for building the factory alongside a central station taking the power direct from the station bus-bars with low transmission costs and losses, and the steam by stage bleeding from the turbines. Unfortunately, it is difficult to find an authority which will co-operate in such a scheme.

It is to be hoped that in a few years it will be possible to solve the problem of works which require large power and little heat by the installation of gas turbines, exhausting to waste heat boilers.

Just as a factory should be so laid out that long ranges of steam mains are avoided,

so also the designer should take account of the handling of materials with a view to economy of labour, capital and power. If the process involves the handling of very large quantities of materials continuously throughout the year, there should be little difficulty in devising a satisfactory arrangement. Incoming wagons of bulk materials may be weighed and emptied on wagon tipplers, and the material may be conveyed by belt conveyors and put into stock piles or withdrawn from them by such means as scraper conveyors, or in the extreme case by bulldozers and by scraper excavators. In such cases, the economy of capital, labour, and power would be high and the most important points to watch are good management and maintenance. In works where the quantities are small and diverse, portable conveyors and mobile cranes may be the best tools to use. Labour economy will probably be the most vulnerable factor.

Utilisation Factor

Usually, the most difficult cases are those works of moderate size where fairly large quantities of diverse materials have to be handled. The worst case of all is that in which materials have to be dealt with at high rate, say, as ships' cargoes, but on only a few occasions during the year. At these times, heavy equipment is badly needed, but the high capital commitment cannot be justified owing to the low utilisation factor.

The solution to aim at is so to lay out the factory that, if possible, several such handling duties are grouped in such a way that they can all be dealt with by the same equipment. For example, one railway wagon tippler might be arranged to discharge boiler fuel as well as cargoes of sulphur or other bulk material. Although the capital cost of the tippler might not be justified for either duty separately, it may be economical for the combined quantities. Such a scheme can be arranged only if the works are so laid out that each material can be delivered from the tippler to its proper destination by a practical system of conveyors and elevators.

A valuable tool for some mixed duties is the overhead telpher crane, with or without grab. The crane can be arranged to command a length of siding on which wagons may stand, as well as a number of stock piles or receiving hoppers, so that each material concerned may be discharged from wagons to stock, and from stock to the point of usage by the same machine. A grab will not discharge wagons as effectively as a tippler since it is always necessary to clean up the bottom of the wagon by hand. However, there is a considerable economy in labour as against hand discharging, and the capital cost need not be excessive since, as well as discharging, the crane may do its own conveying and elevating.

A valuable application of a telpher crane and grab may be the rough blending of boiler fuels. Alternating grabs-full can be taken from two wagons or stock piles containing different types of coal. They should preferably be dumped into separate hoppers with feeders delivering on to a mixing belt or worm conveyor. If no such plant is available, alternating grabs may be dropped direct into the boot of the elevator or other plant which feeds the stoker. No one would claim that such an arrangement gives real blending, but in the works for which the author is responsible some of the fuels which are received will not burn on the grates to give anything like the output which is required, unless some less bad coal is mixed in this way.

The Scotch derrick and grab is another type of installation of moderate capital cost which might be used to handle a variety of materials from wagons into or out of stock piles disposed radially around it, and such an arrangement could also no doubt be used for mixing fuels. This crane calls for a rather higher level of skill to operate it safely, than is the case with the telpher, and the area which it commands cannot be so readily extended as can that of the telpher.

Economy of Water

The use of water for process purposes often has aspects very similar to those of the use of steam. Water is commonly used for two purposes, (a) for transferring heat both for heating and cooling operations, and (b) for process reactions and solution, under which heading may be included many cases of scrubbing effluent gases and the removal of waste products. These two aspects can often be considered together with advantage, since (for example) water for reaction may be required at a temperature which can be provided by the carrying out of a cooling operation.

When water is used for removing heat, it is frequently required to do so at the lowest available temperature. In this respect, its use is analogous to, but the inverse of, the use of steam for heating, and just as heat should, where possible, be applied at its highest temperature to make the intake temperature a maximum, so also cooling water should be applied to the same service at its lowest temperature in order to make the exit temperature a minimum.

Water is in itself a valuable commodity, but in almost all cases its use involves capital cost for installation and power for pumping. After use for low-temperature cooling, it should be passed on progressively through duties which may be cooled at successively higher temperatures and finally, having collected all the low-grade heat which may be made available in this way, it should be appropriated to those duties in which this

low-grade heat may be valuable, either for space heating, lime-soda water softening, or boiler feed.

Once again, these economies will be most easily and effectively achieved if they receive consideration in the early stages of design.

Economical Use of Labour

A wide use of unskilled labour is often associated with a saving of capital costs and a saving of the use of skilled labour for the maintenance of machines. As an example, a battery of hand-fired Lancashire boilers, does not generally make heavy demands on the maintenance and instrument departments or on the laboratory for the control of feed water. Even the engineering staff will not often be called out in the middle of the night because the coal is putting the fires out.

On the other hand, highly rated water-tube boilers with mechanical firing reduce the amount of unskilled labour which is required, but make heavier demands on the service branches. While full automatic control will probably not save one man per shift on the firing floor, it will certainly call for a substantal fraction of an instrument man and probably a fitter or electrician to keep it working. Justification for automatic control should be looked for in more efficient boiler operation and greater power production by maintaining a more constant stop-valve pressure on the turbine or engine.

A CO_2 recorder can be a most valuable aid to increasing the day-to-day combustion efficiency of boiler or other furnaces. It is useless to instal such an instrument unless provision is made to keep it in good working order, and to apply the information which it makes available. In order to get the best results in this direction, it may be that a bonus should be paid on CO_2, but this may be a dangerous cause of discontent unless the instruments are kept in first-class working order, and for this purpose, a man of good intelligence and skill and of high integrity must give an important part of his time to this one job. The savings should very well cover this expenditure; but in planning a factory provision must be made for an adequate instrument department and workshop, and it is advantageous if this shop can be close to the engineers' office so that to the man in charge of instruments can be assigned the duty of bringing to the attenton of the chief engineer any notable or unusual irregularities or other information which the instruments provide.

Capital and Management

Reference has been made to the relation between capital expenditure and other aspects of economy. Chemical processes differ in the extent to which capital charges influence total costs. In the case of fine chemicals, they are not usually very important, and there should be very little case for restricting fuel economy measures on this score. On the other hand the smaller fine chemical companies do not always spend enough money on good engineering management to ensure high energy efficiencies. It is on the heavy chemical side of the industry that capital charges often assume significant proportions, and once the capital cost of the equipment has been incurred nothing can be done to reduce these costs, except by writing off against profits, or by increasing the output of the plant.

Since chemical plant is always subject to change and improvement of process its value must usually be written down in a fairly short period, and this fact increases the difficulty in justifying heavy expenditure on items which will increase fuel economy, *e.g.*, those large heat transfer surfaces which make for small irreversible heat drops. Fortunately, steam raising and power generating plant can generally be written off over longer periods, and it is therefore easier to show cause for installation of the best and most efficient plant which is available.

Poorer Fuels

It appears that in the future much heavier capital costs will have to be carried for firing equipment. In the past there was good justification for providing moderate-sized boilers with simple grates and induced draught only, to burn good quality washed and sized coals, but now that there seems to be no prospect of obtaining anything but slacks of widely varying volatile, ash, moisture, and screen analysis, it is necessary to adopt much more costly plant to ensure maintained efficiency and, what is even more important, maintained ability to carry the factory load.

The capital cost of extensive instrumentation will be high, and if it is not combined with good management to make use of the data thereby obtained, this cost will be of no avail, but on the other hand good managers will be used at something less than their maximum efficiency if they are not provided with adequate instrument records.

In drafting this paper, an attempt has been made to show that isolated projects for fuel economy may be hampered or even rendered abortive unless works and processes are designed from the outset with due consideration for all the factors reviewed. It is admitted that, in the main, problems have been propounded without defining their solutions. This is inevitable, since an equation having so many variables must have many solutions, and usually the correct answer can be found only by successive approximations, that is to say, by the hard road of working out the over-all cost of a number of alternative schemes until the cheapest has been determined; in this con-

nection, consideration of which plan is the cheapest should take account of what assets are nationally most cheaply available.

There is only one way in which these calculations may be curtailed, and that is by the application of wide and intelligently assimilated experience, but it should be remembered that even such experience must be reassessed in the light of present and future conditions of stringency.

The main fact which emerges is that, as the power to calculate and the power to exercise judgment are both required in high degree if works are to be designed and built for the best economy, then it is only by employing designers and managers of the highest quality and in adequate numbers that this country will be able to offset its shortage of other assets, and so compete successfully in world industry.

Chemical Industry in Austria

Former Influence of I.G.

THE position of the chemical industry in Austria is at present influenced not only by present conditions but also by circumstances going back to before 1938. In consequence of the dominating influence of the German chemical industry, especially of the mammoth concern of the I.G. Farbenindus trie, Austria never developed a domestic wholesale manufacture of chemical products although various endeavours were made. Only in a few products, *e.g.*, production of sulphuric acid, superphosphates and other heavy chemicals, was home production established, but for most chemical products there was dependence on Germany. This dependence increased between 1938 and 1945 Although the manufacture of chemical products in Austria increased, and new factories started, the unfavourable situation which existed before the war has not really improved.

This unfortunate situation, which would handicap the future large-scale production of heavy and fine chemicals, has been recognised by the authorities. Serious efforts now being made to create a chemical industry based upon domestic raw materials and upon foreign semi-finished products, which would in quantity and quality correspond more closely to the demands of the Austrian economy and would even allow for an export of chemical products. A prerequisite for such a development would be the clearing up of the now unsettled patent situation, agreements on credits, and, above all, the removal of German influence. As it is still uncertain in what way and how far the dominating I.G. Farben concern will lose its influence, or who will take it over, definite prophecies are not yet possible. But, as regards raw materials, it seems certain that a considerable advance by the Austrian chemical industry is possible, following the elimination of German competition in Austria and in many parts of Europe.

Domestic tar manufacture for the production of organic chemicals, especially phenol, which is going to start on a large scale next spring, will supply a future organic chemical industry with the necessary semi-finished products. Plastics, dyestuffs, salicylic acid, acetylsalicylic acid (aspirin) and various other pharmaceuticals will be produced. Great importance is attributed to the proper use and consumption of petroleum and natural gas. By virtue of the extension of petroleum production, the raw material base for organic chemicals is on a better footing than in 1938. But it is still necessary to establish cracking plants to allow a sufficient production of benzene and its derivatives for home consumption. It may, in the long run, even be possible to export raw oil and oil products. The de-paraffining plants which are to be built would not only produce sufficient quantities of paraffin liquid and wax for the home market but would also leave a surplus for export. Up to now paraffin has had to be imported. The natural gas and the cracking plants would allow the production of solvents, such as methylene chloride, dichlorethylene, isopropyl alcohol, acetone, acetic acid ester and of certain bases, such as ethanolamine and morpholine, the production of which is already projected.

In the sphere of metallurgy it may be mentioned that as Austria possesses one of the largest aluminium works in Europe, aluminium and its alloys can be exported in large quantities. Similar conditions apply for magnesium because Austria disposes of the richest deposits of magnesite.

Efforts are being made to start iron smelting in electro furnaces, as in Sweden and Italy, whereby considerable quantities of coal could be saved. Austria has sufficient waterpower to produce cheap electricity which would be of the greatest value for metallurgical and electro-chemical works, *e.g.*, for the production of ferromanganese, ferrochromium, ferrosilicon and for the hardening and welding processes in electric furnaces.

All the problems mentioned above are being dealt with by a council of the Faculty for Chemistry at the Technical High School, Vienna for "Investigation of the Possibilities of a Rebuilding of the Chemical Industry in Austria." Its work already justifies an optimistic view of the future of the Austrian chemical industry.

I.C.I. and China

British Technicians Sent Out

IMPERIAL Chemical Industries may manufacture in China, in partnership with the Chinese, Lord McGowan, chairman of I.C.I. told an audience in London recently. Speaking at an Anglo-Chinese Chamber of Commerce luncheon at Grosvenor House, he said that before China could develop and expand her own industrialisation, with British financial help to aid the erection of factories, we should want to see political stability. "Investment," he said, "presupposes security of tenure and sound government, and speaking very frankly, those conditions do not at present exist. At the appropriate time I.C.I. is prepared to manufacture in China in partnership with the Chinese, and we have frequently exchanged ideas with Chinese interests, but the time is not yet ripe for developing that policy."

Lord McGowan said his company would strain every nerve to help China put her house in order. Already several I.C.I. technicians had been sent out, and they planned to send more.

Chemical Candidates

Widnes Council Redistribution

OWING to a rearrangement of the wards in the municipal borough of Widnes, more interest than usual is being taken in the election of borough councillors which is to take place on November 1. For the 24 seats which have to be filled, 44 candidates have come forward; and, as is not surprising in this great centre of the British chemical industry, not a few of them have intimate working connections with the industry. The following names are well known in local chemical circles, and many of them are of considerably wider reputation. Names marked with an asterisk are councillors seeking re-election.

Farnworth Ward: *Dr. J. P. Baxter, B.Sc., Ph.D. (Cons.), director, General Chemicals Division, I.C.I. Appleton Ward: Mr. F. J. Heyes (Cons.), Mr. F. J. Knight (Cons.), respectively chairman and secretary, Insulating Materials, Ltd.; Mr. Aneurin Williams, B.Sc. (Ind.), research chemist with I.C.I. (formerly United Alkali). Halton Ward: *Mr. J. H. Collins, B.Sc. (Lab.), research chemist with I.C.I.; *Mr. J. Fisher (Lab.), fitter in the Pilkington-Sullivan Works of I.C.I.; Mr. H. P. Minton (Ind.), a technical chemist who has been a member of the B.A.C. (Liverpool Section) for 25 years, and has served as chairman and councillor of the section; Mr. John Watson (Lab.), also a chemist with I.C.I., formerly in United Alkali. Woodend Ward: *Mr. R. Tough (Lab.), formerly assistant to Dr. Baxter at Billingham and now vice-chairman of Widnes Trade Union Council; *Mr. F. Traynor (Lab.), fitter at the Gaskell-Marsh Works of I.C.I. Kingsway Ward: *Mr. J. E. Bailey (Lab.), assistant physicist at Widnes Research Laboratory (I.C.I.); Mr. F. Tollitt (Lab.), of McKechnie Bros., head shop-steward for the C.W.U. Lowerhouse Ward: Mr. W. L. Dutton, A.R.I.C. (Lab.), analytical chemist at Widnes Research Laboratory, and founder-member of Widnes Branch, A.Sc.W. Ditton Ward: Mr. J. Longton (Cons.), on the I.C.I. clerical staff; Mr. C. McGloin (Lab.), at McKechnie Bros., a member of the C.W.U.

New Control Orders

Removals from Export Licence Control

SOME changes in the list of goods subject to export licensing control are made by *The Export of Goods (Control) (Consolidation) Order*, 1946 (S.R. & O., 1946, No. 1661). Export licences now become necessary for dinitro-ortho-cresol preparations. The following no longer need licences for their export to any destination: Acetyl salicylic acid; arecoline and its salts; bismuth compounds; caffeine and its salts; chiniofon; chloral hydrate; chrysarobin; guanidine carbonate; guanidine nitrate; heparin; hydrastine and its salts and preparations thereof; hydrastis; 8-hydroxyquinoline and its compounds; liver extracts; mannitol; pancreatin; papaverine and its salts para-chlor-meta-xylenol; phenothiazine; pilocarpine and its salts; rhubarb (rheum); salicylic acid; senega; sodium salicylate; strychnine and its salts; sulphamethazine and its preparations; sulphathiazole and its derivatives and preparations thereof; thymol; urethane.

FOAM SUITS

It is reported in the *Journal of Chemical Education* that a protective "foam suit" which enabled men who fell into the sea to keep warm for two or three hours was developed in Germany during the war. A foam-producing powder was rubbed into the wool-like pile of an acetate rayon middle layer of a three-layer garment. The powder generated foam immediately upon contact with sea water. Foaming continued for a long period, even when the powder was greatly diluted. The resulting layer of foam between the middle and outer fabric layers of the suit protected the wearer from an excessive drop in body temperature. Foam powder for use in the North Atlantic and the North Sea contained sodium bicarbonate, citric acid crystals, benzoic acid crystals, a gelatin emulsion, and two other chemicals bearing German trade names.

Parliamentary Topics

Foreign Scientists in U.K.

IN the House of Commons, last week, Mr. Cobb asked the Minister of Labour whether he would give an estimate of the number of foreign scientists who had accepted permanent employment in this country during the last 15 years; and, in view of the prospective shortage of scientific manpower as envisaged in the Barlow Report, what steps were being taken to enlist the services of additional qualified foreign scientists until requirements could be supplied from British universities.

Mr. Isaacs replied that the answer to the first part of the question was "No, sir." In regard to the second part, every effort was made to utilise the services of foreign scientists in this country whose qualifications were in demand and who were known to be available. Though no general steps had been taken to enlist the services of foreign scientists from outside the U.K., arrangements had been made for the entry into this country of a number of scientists possessing knowledge and experience of a special value.

Labour in Foundries

Mr. Peter Freeman asked the Minister of Labour to what extent the placing of Italians and Germans in foundry work was due to shortage of labour and why apprentices to that work were being called to the Forces.

Mr. Isaacs said the proposed employment of Italians in ironfounding was entirely due to the shortage of suitable British labour. Deferment was given on application in the case of all young men in ironfounding, including apprentices.

German Development

The Chancellor of the Duchy of Lancaster, Mr. J. Hynd, was questioned by Mr. E. Davies whether the British Government was taking part in the loan for industrial development of Germany now being proposed by the U.S. Government. In reply, Mr. Hynd said H.M. Government was not participating. The American proposals, he affirmed, were designed not for the industrial development of Germany in general, but to finance the import of certain raw materials for specific export programmes.

Price Control

In a written question, Major Lloyd asked the President of the Board of Trade the average time taken by the Price Control Committee of his department in considering applications from a manufacturer to increase a selling price. Sir Stafford Cripps told him the information could not be obtained without an unjustifiable expenditure of time and labour.

Japan's Industries

Questioned by Mr. Rees-Williams about the ownership of industries in Japan, Mr. McNeil said that the great holding companies which had a stranglehold on Japanese industry were to be dissolved. A Holding Company Liquidation Commission had just begun work in Tokyo, and the question of the ownership of industries after the break-up of the holding companies was under discussion in the Far Eastern Commission.

Admiralty Chemists' Pay

Colonel Wheatley asked the Parliamentary Secretary to the Admiralty whether he would give an assurance that the carpenter scientific staffs of the Armament Supply Department would be placed on the rates of pay in accordance with the White Paper with regard to the Scientific Civil Service, 1945, and thus bring them into line with the carpenter scientific staffs in other Admiralty Departments.

Mr. W. Edwards: "No, Sir. I assume that the staff whom the hon. and gallant Member has in mind are chemists employed on the production side of the Royal Naval Propellant Factory. The revision of their rates of pay is, however, under consideration."

Penicillin Control to Remain

Sir John Mellor asked the Minister of Supply whether he was satisfied that sufficient penicillin was now available for United Kingdom requirements, and whether he would revoke the Control of Penicillin Order. Replying, the Minister of Supply (Mr. John Wilmot) said that although the supply position had improved considerably, the removal of control measures would not be justified at present. The scope of the Order was, however, being extended to allow registered veterinary surgeons to acquire penicillin supplies. He thought it undesirable to allow penicillin to be used indiscriminately. In answer to a later question the Minister admitted that British penicillin was now being exported.

Metal Containers

Colonel Wheatley asked the Minister about the shortage of large metal containers, and was told the position was being reviewed.

The opening of the asbestos deposits in the Lewis Brook area of Newfoundland has been started by a Canadian asbestos-mining concern. Samples with a 30 per cent. asbestos content have been reported, and it is stated that the iron content is low.

Personal Notes

Mr. Bob Edwards, North-West area officer of the Chemical Workers' Union since 1938, has been appointed assistant general secretary.

The following have been appointed lecturers in the Chemistry Department of the Sir John Cass Technical Institute, London, E.C.: Dr. W. Wilson, M.Sc., A.R.I.C., from Northampton Polytechnic; Mr. F. Holmes, B.Sc., A.R.I.C., from Woolwich Polytechnic.

Dr. John Eggert, formerly Professor of Physical Chemistry and head of the central laboratories of the I.G. Farbenindustrie-Agfa in Berlin and Bitterfeld, has been appointed by the Swiss Federal Council to the post of Professor of Photography at the Federal Technical College, Zürich.

Dr. C. H. Lander, president of the Institute of Fuel, has accepted an invitation from the Minister of War to act as Dean of the Military College of Science at Shrivenham, Wiltshire. He will be specially concerned with the civilian side of the instruction provided.

Dr. H. Gothfeldt, M.Inst.W., has been awarded by the Council of the Institute of Welding the Sir William J. Larke Medal and a prize of £50, for a paper entitled "Welded Drag Line Booms of 150 feet Length." The paper, which describes the fabrication of welded drag line booms for use in open-cast coal workings, will be read at a meeting of the Institute in London on October 31.

Dr. Patrick D. Ritchie, present head of the chemistry department at Leeds College of Technology, has been appointed head of the department of chemistry of the Central Technical College, Birmingham, following the retirement of Dr. J. A. Newton Friend. Dr. Ritchie has done a great deal of research in plastics, and when he takes over his new duties in January he will direct a new laboratory devoted to education in the technology of plastics.

Professor J. Heyrovsky, director of the Physico-Chemical Institute, Charles University, Prague, and inventor of the polarograph, is on a visit to Britain arranged by the British Council. He is visiting the National Physical Laboratory, the Royal Institution, the Imperial College of Science and other Institutions, and is lecturing to University and professorial audiences at Sheffield, Leeds, Cambridge, and Aberystwyth.

Dr. T. W. J. Taylor, C.B.E., M.A., D.Sc., Fellow of Brasenose College, and Lecturer in Chemistry in the University of Oxford, has been appointed principal-designate of the new West Indian University College which is to be established in Jamaica, in accordance with a decision of the Secretary of State for the Colonies. Dr. Taylor is well known in many chemical fields outside Oxford, having served on the Council of the Chemical Society in 1936-39. and having been a governor of the Royal Holloway College in the University of London. Among his numerous chemical publications probably the best known is his new edition (1937) of Sidgwick's *Organic Chemistry of Nitrogen*, in collaboration with Dr. W. Baker. Dr. Taylor's appointment is effective from October 1, 1946.

Obituary

Mr. Otto Cyren, a director of the Swedish Department of Chemical Industry since 1944, and a well-known chemical engineer, died in Sweden on September 23, aged 68. Educated in the Chalmers Institute at Gothenburg, his birthplace, and at the Zürich Polytechnic, he gained experience in various chemical works in Germany before returning to Sweden in 1917.

A New Insecticide

Brought from U.S.A. by Dr. West

The announcement of a new organic insecticide, Velsicol 1068, was made last Tuesday by the Hygienic Chemical Company at a luncheon at the Savoy Hotel, London. Among the many guests who heard details of the new compound were well-known chemical manufacturers, industrialists, academic scientists, and representatives of the daily and technical Press.

Dr. T. F. West, well known for his DDT studies, was responsible for the introduction of Velsicol to this country. He explained that it will be slightly more expensive than DDT, but emphasised that it will be complementary to DDT and Gammexane. The new insecticide is a little more toxic to animals than DDT, but it can be used at greater dilutions. Velsicol he claimed, is more toxic than other substances against certain stages of development of the German cockroach. It is also exceptionally effective against bugs, grain insects, houseflies, locusts, mosquitoes, and an aphid.

The new insecticide was discovered in the laboratories of the Velsicol Corporation in Chicago, following publication of a theory to explain the reason for the insecticidal activity of DDT put forward by two British workers, Dr. Hubert Martin, and Dr. R. L. Wain. The compound has the composition $C_{10}H_6Cl_8$, which provided part of its trade name.

Further details of this compound will be given in a later article in The Chemical Age.

A CHEMIST'S BOOKSHELF

The Chemistry of Free Radicals. By W. A. Waters. Oxford University Press. Pp. 284. 20s.

If one were asked for a generalisation on the trend of organic chemistry it would be fair to say that until recently most energy has been expended in the preparaton of compounds and the elucidation of their relation to each other, while a large amount of present-day research is directed at answering the question how a certain reaction takes place. If a relatively simple reaction is considered, from either organic or inorganic chemistry, it is surprising to find that in many cases there is no clear idea as to how the reaction occurs. Such, for instance, is the case in the Gatterman reaction where copper powder appears to have a catalytic effect on a diazonium salt.

Since classical organic chemistry had put forward the view that a radical was a group of atoms which remained unchanged in most sequences of reactions and could not exist separately, a great deal of interest was aroused by Gomberg's discovery, in 1900, of the free radical triphenylmethyl which he prepared from hexaphenyl-ethane. A whole range of analogous compounds was formed soon afterwards, although it was not until 1929 that Paneth and Hofeditz obtained evidence for the existence of free methyl.

Free radicals have been defined by Wieland as "complexes of abnormal valency, which possess additive properties, but do not carry an electrical charge and are not free ions," and it is with such complexes that Dr. Waters's present book deals.

The introductory chapter consists of a short historical approach where the discovery of the more important free radicals is reviewed and the original apparatus used is illustrated and described. The following chapter deals with the physical properties of free radicals and it is to be noted that since they always contain an odd number of electrons they will be paramagnetic, a fact which affords a convenient method of estimating the degree of dissociation into free radicals. A description of the methods available for the preparation of free radicals is then given and, since the author has drawn no arbitrary distinction between the branches of organic and inorganic chemistry, this also includes a description of such radicals as atomic hydrogen, nitrogen, and chlorine.

The remaining chapters give an account of the various reactions which involve free radicals. These reactions are taken from all branches of chemistry and are grouped according to their fundamental mechanisms. Thus we have a chapter on each of the following topics: reactions of alkyl radicals, aryl radicals, radicals as catalysts, reactions involving metals, oxidation, and finally a chapter briefly outlining some possible mechanisms in biochemistry which may be accounted for by assuming the occurrence of free radicals.

In the course of these chapters such widely different topics as the Kolbe reaction, diazonium solutions, Perspex, and electrode reactions are dealt with. Throughout there are numerous references to the literature and, in view of the otherwise excellent way in which the subject matter is presented, it is a pity that these references are indicated by asterisks and daggers, etc., in such a way as to make them indistinguishable from the accompanying footnotes.

The present volume is the first book of its kind to be published in England and as such has set out to review all the pertinent experimental work to date from which conclusions have been drawn and in some cases theories propounded. Whether these prove to be correct, only time, and further research, will tell. The book may be confidently recommended to a very wide range of scientists. It is a volume, not only for the physical chemist who is interested in rates of reaction, but for all chemists, whether they specialise in organic or inorganic work, who are interested in finding an answer to the question of how substances react. It will likewise be appreciated, both as a textbook and a work of reference, by the industrial chemist concerned with macromolecules, since due mention is given to synthetic polymers.

Where to Find Information on the German Chemical Industry. By L. Wilson Greene. Published by the author, 54d Oak Grove Drive, Baltimore, Maryland. Pp. 40. $1.

The author of this useful little bibliography is Senior Consultant to the Chemical Corps Technical Command U.S. Army, and formerly held important staff appointments in the U.S. Chemical Warfare Service; so that it is to be expected he should have a good knowledge of American literature dealing with the subject in hand. What is perhaps not surprising, but at any rate gratifying, is that he is conversant also with the material published in England, so that his bibliography is made the more complete. It is arranged conveniently in two sections, one covering published articles, the other a list of the most important reports that can be bought from the U.S. Office of Technical Services; and it is provided with a concise subject-index. The author adds a note to the effect that he is planning a similar guide to the German metallurgical industry, and would appreciate suggestions furthering the utility of such handbooks.

General News——From Week to Week

Nine people were injured, six being detained in hospital, when a refuse bin exploded outside Messrs. Bibby's, Liverpool.

The present procedure, whereby veterinary surgeons obtain penicillin through specially licensed suppliers, will end on October 31.

A fire at the Pan Britanica fertiliser factory at Sewardstone Road, Waltham Abbey, was confined to the first floor by firemen from Ponders End, Enfield and Waltham Abbey.

The radio telephone service to liners at sea is now available from 7.15 a.m. to 9.15 a.m., and from 12 noon to 8 p.m. G.M.T. daily, except on Sundays.

The Textile Institute announces that William Parkin (Bradford Technical College) was among this year's successful candidates in the final examination for the Ordinary National Certificate in Textiles.

A Drug Requirements Advisory Committee to " compile a list of those drugs considered to be necessary for the health of the community " is to be set up by the Ministry of Health.

Unregistered air mail letters at 1s. 6d. per half oz. may now be sent to Korea, and unregistered postcards, relating to personal and domestic matters only, may be sent to Japan.

The Great Western Railway has placed an order with British Brown-Boveri Limited for a gas turbine locomotive which will develop an output of 2500 h.p. and be capable of a maximum speed of 90 m.p.h.

Glasgow Corporation's Provan chemical works are to be extended in conjunction with Provan Corporation gasworks, by the installation of two modern units. one to produce sulphate of ammonia and the other to distil tar acid.

The Ministry of Supply announces that the stock of non-ferrous scrap metals on charge on September 30 was 183.752 tons. Sales for the two months August-September amounted to 18.286 tons (approximate value £910,000).

A submarine cable, 200 nautical miles long and insulated with polythene, has been laid direct to Germany since the end of the war. This is the longest telephone cable between this country and Europe. A submerged repeater has been included in the cable.

During August the following cases were reported under the Factories Act or the Lead Paint Act. Lead poisoning, 1; aniline poisoning, 4; anthrax, 1; skin cancer, 32, (pitch 16, tar 14, oil 2); chrome ulceration, 2. There was one death from lead poisoning —a metal smelter.

The telephone service between this country and Bulgaria has been restored with a minimum charge for three minutes of 24s. from England and Wales, and 2s. 6d. extra for calls from Scotland, Northern Ireland and the Isle of Man.

The strike of 400 workers at the Rutherglen works of Messrs. J. & J. White, Ltd., chemical manufacturers, which has been in progress for four weeks, shows no sign of ending soon. Strike action was taken by the men when several employees were dismissed on the grounds of redundancy.

At a conference held in Glasgow last Saturday a project was discussed for setting up a coal-distillation plant in the Shotts district, with a view to revitalising the industry of Lanarkshire. It is expected that the projected scheme, through the creation of subsidiary industries, would give employment to some thousand workers.

A Northern Ireland branch of the Society of Dyers and Colourists has been formed, with officers as follows: chairman, Dr. T. E. Ellison; hon. secretary, Mr. J. Porter, 20 Abbeydale Gardens, Crumlin Road, Belfast; committee, Mr. E. Butterworth, Mr. D. A. Derrett Smith, Dr. M. Gewing, Dr. W. Honneyman, Mr. J. H. Jackson, Mr. W. J. Macnab, Mr. J. Montgomery, Mr. F. C. Oldham, Mr. J. A. Rodgers.

Before he left the Colonial Office to take up his new post as First Lord of the Admiralty, Mr. George Hall announced the appointment of six members of the Colonial Development and Economic Council which is to advise on the plans for economic and social development in the colonies. The six members are Viscount Portal, Mr. J. Benstead, Sir Bernard Bourdillon, Sir Graham Cunningham, Sir William Goodenough and Sir Drummond Shiels.

Illustrated descriptions of all inventions patented in the United Kingdom are published in *Abridgments of Specifications of Inventions* issued by H.M. Patent Office. This publication constitutes a record in classified form of recent developments in all branches of invention for which patents have been granted and is invaluable to research students and specialists. The Abridgments are divided into 40 Groups, each Group relating to a special field of invention, a volume of each Group as issued covering a series of 20,000 published specfiications of inventions. The volumes now in course of preparation can be supplied sheet by sheet (16 pages) post free as issued for a subscription per vol. of 5s. (inland); 7s. 6d. (abroad) The number of the Group or the subject of interest should be sent with all subscriptions.

Civilian travellers entering or leaving Britain may carry £20 in sterling notes, states a new Treasury Order. Outward-bound travellers may also take £10 worth of foreign currency, and inward-bound travellers may bring in varying amounts in foreign notes, according to the currency involved. No restrictions are placed on the passage of sterling or foreign notes between the U.K., Eire, and the Channel Islands.

A sound-colour film made by Potash, Ltd., and dealing with different aspects of fruit, vegetable and flower culture in the principal horticultural areas in Great Brita'n has just been released. According to general opinion, this film achieves a high standard of quality in colour reproduction and other technical features. Applications for demonstrations from N.F.U. branches, horticultural societies and clubs should be sent to the Field Service Department, Potash Limited, 112 Fenchurch Street, London, E.C.3.

Foreign News

The production of tin at the Longhorn smelter in Texas is increasing steadily and current operations are at the rate of about 44,000 tons a year. The Texas City smelter began operations in April, 1942, and has already produced about 150,000 tons.

The first catalytic petroleum-cracking plant in Canada is to be erected at Montreal East, by Imperial Oil, Ltd. The programme includes the construction of a polymerisation plant with a daily capacity of 4200 barrels, it is reported.

Under the terms of a trade agreement which is being discussed between the French Government and an Austrian delegation, France would supply chemical and pharmaceutical products, fertilisers, and other goods in exchange for steel, magnesium and timber.

A commercial agreement has been concluded for the period ending April next, between Sweden and Eire, by which, in exchange for Swedish timber products, plywood, paper and pulp, Eire will supply Sweden with woollen goods and mineral products of various unspecified categories.

In the U.S. zone of occupation in Germany, raw graphite is being imported from Austria, while Yugoslavia has bought graphite electrodes, manufactured in the zone, to the value of $12,000. Norway and Sweden have each contracted to import 300 tons of bauxite from the same zone.

The Swiss Society for Analytical and Applied Chemistry held its annual general meeting recently in Solothurn. A number of delegates from foreign universities attended. Ten papers were presented including one by the president, Dr. R. Viollier, Basle, on "Physico-Chemical Methods for the Characterisation of Proteins."

The sunflower-seed crop in Argentina for this year is officially estimated at 890,000 metric tons, compared with 985,000 tons last season. The production of quebracho in 1945 was 726,565 tons of wood, which yielded 232,372 tons of extract, comprising 121,575 tons of the type soluble in cold water and 110,797 tons of the type soluble in hot water.

Copper acetate and a black water-soluble dyestuff bonded with a wax binder have been used by the U.S. Navy as a shark repellent in the Pacific. At first copper acetate alone was used, and, diffusing slowly into the water, the chemical repelled sharks; but since sharks have a visual response to food as well, the black dyestuff was added to make the repellent more effective. One bag of the acetate hung below water gave protection for about three hours.

Forthcoming Events

October 26. Institution of Chemical Engineers (North-Western branch, jointly with Liverpool section of S.C.I.). Stork Hotel, Queen Square, Liverpool, 3 p.m. Dr. L. J. Burrage: "Some Aspects of Adsorption by Activated Charcoal."

October 26. Royal Institute of Chemistry (London and South-Eastern Counties section). Letters Lecture Theatre, Reading University, 2.30 p.m. Professor H. L. Hawkins: "The Geology of Water Supplies"; Mr. W. Gordon Carey: "The Chemistry and Bacteriology of Water Supplies."

October 28. Society of Chemical Industry (Agriculture and Food Groups). Chemical Society's rooms, Burlington House, Piccadilly, London, W.1, 6.30 p.m. Professor G. L. Baker: "Agricultural Delaware and its Supporting Research"; Professor J. A. Scott-Wilson: "Agricultural Research and Farming Progress."

October 29. Hull Chemical and Engineering Society. Jackson's Restaurant, Paragon Street, Hull, 7.30 p.m. Annual dinner.

October 29. Society of Instrument Technology. Royal Society of Tropical Medicine, Manson House, Portland Place, London, W.1, 7 p.m. Mr. S. Hill: "The Standard-Sunbury Engine Indicator."

October 29. The Chemical Society (jointly with Edinburgh University Chemical Society and local sections of R.I.C. and S.C.I.). Edinburgh University, 7 p.m. Dr. D. J. Bell: "Some Observations on Biological Oxidation and Reduction."

October 30. British Association of Chemists (London Section). Gas Industry House, 1 Grosvenor Place, London, S.W.1, 7 p.m. Mr. H. C. Stephenson: "Protection Against Industrial Poisons."

October 31. Royal Institution. 21 Albemarle Street, London, W.1, 5.15 p.m. Professor J. R. Partington: "History of Alchemy and Early Chemistry—I."

October 31. Society of Public Analysts. Geological Society's Rooms, Burlington House, London, W.1, 6 p.m. Professor J. Heyrovsky: "The Fundamental Laws of Polarography."

October 31. Imperial Institute (Mineral Resources Department). Cinema Hall, Imperial Institute, London, S.W.7 (East Entrance), 3 p.m. Mr. C. B. Bisset: "The Work of the Geological Survey of Uganda."

November 1. Chemical Society. Joint meeting with University College of Swansea Chemical Society. University College, Swansea, 6 p.m. Professor D. H. Hey: "Homolytic Reactions."

November 4. Oil and Colour Chemists' Association (Hull Section) Royal Station Hotel, Hull, 6.30 p.m. Professor T. P. Hilditch: "Mechanism of Oxidation and Reduction of the Unsaturated Groups in Drying Oils."

November 4. Society of Chemical Industry (London Section; joint meeting with the Institute of Fuel). Institution of Electrical Engineers, Savoy Place, London, W.C.2, 6 p.m. Dr. C. C. Hall:: "The Operation and Development of the Fischer-Tropsch and Related Processes in Germany."

November 5. Hull Chemical and Engineering Society. The Church Institute, Albion Street, Hull, 7.30 p.m. Dr. A. N. Mosses: "Fireworks in War."

November 5. Institution of Chemical Engineers. Geological Society's Rooms, Burlington House, London, W.1, 5.30 p.m. Mr. W. F. Carey: "The Effect of Using Hot Air in Grinding Systems."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

CURWEN-MILLER CO., LTD., Bristol, paint and polish manufacturers. (M., 26/10/46.) September 30, £3000 (not ex.) mort., to Lloyds Bank, Ltd.; charged on 43 Stokes Croft St. James, Bristol. *Nil. December 30, 1944.

BRITISH CELANESE, LTD., London, W. (M., 26/10/46.) September 24, Trust Deed dated September 16, 1946, securing £1,000,000 3½ per cent. second debenture stock 1951/80 with a premium of 2 per cent. in certain events; general charge (subject to etc.). *£3,722,761. December 25, 1945.

CARBO-ICE INDUSTRIES, LTD., Treforest. (M., 26/10/46.) September 26. debenture, to C. M. W. Trust, Ltd., securing all moneys and liabilities which are now or at any time hereafter may be incurred and actually paid by the holders under a guarantee but not exceeding £5000; general charge. *Nil. July 5, 1946.

VITREOUS ENAMELLING INDUSTRIES (BRADFORD) LTD. (M., 26/10/46.) September 26, mortgage and charge, to Midland Bank, Ltd., securing all moneys due or to become due to the Bank; charged on Alexandra Shed, Parsonage Road, Laisterdyke, Bradford, with machinery, fixtures, etc., also general charge.

ANTISEPTIC PRODUCTS, LTD., Maidstone, chemists. (M., 26/10/46.) September 12, charge, supplemental to a debenture dated September 1, 1945, to Anglo-Federal Banking Corporation, Ltd., securing all moneys due or to become due to the Bank; charged on 105 and 105a Tonbridge Road, Maidstone (subject to etc.). *£4,725. September 10, 1946.

Satisfactions

NUTILUS PRODUCTS, LTD., Kingston-on-Thames, chemists, etc. (M.S., 26/10/46.) Satisfactions September 30, of debentures registered October 31 and December 15, 1938.

STEWARTS & LLOYDS, LTD. (incorporated in Scotland). (M.S., 26/10/46.) Satisfaction October 3, of debenture stock registered February 8, 1934, to the extent of £19,000.

UNITED STEEL COMPANIES, LTD. Sheffield. (M.S. 26/10/46.) Satisfactions September 27, balances of £28,502 7s. 9d., £9052 6s. 9d. and £7250 19s. 6d., registered February 16, 1931.

Company News

Settle Limes, Ltd., have declared an ordinary dividend of 6 per cent. (4 per cent.) for the year ended July 31.

Sadler & Co., Ltd., with a net profit of £3104 (£4862) for the year ended June 30, are paying a dividend of 6 per cent. (5 per cent.).

Borax Consolidated, Ltd., announce that a final dividend of 3 per cent., less tax will be paid on December 2 on their preferred ordinary stock. The last time a final dividend paid so early was in 1929.

Murex, Ltd., announce a net profit, for the year to June 30 last, of £201,490 (£213,032). A final ordinary dividend of 10 per cent. and a cash bonus of 2½ per cent. make a total of 20 per cent. (same).

Aspro, Ltd., for the year ended June 30, report a net profit of £424,695 (£284,512), and have declared a final ordinary dividend of 25 per cent. (15 per cent.), making a total of 35 per cent. (25 per cent.).

British Alkaloids, Ltd. (manufacturers of "T.C.P.") are paying, in respect of the year ending March 31 next, interim dividends of 16.6 per cent. (10 per cent.) on the 8 per cent. participating preference, and 25 per cent (15 per cent.) on the ordinary shares.

New Companies Registered

Frago (Export) Ltd. (421,250).—Private company. Capital £100 in £1 shares. Exporters, importers, buyers, sellers and manufacturers of plastics, metals, chemicals, etc. Director: H. Barker. Registered office: 39-41 Swan House, 133 Oxford Street, W.1.

Furness (Coals) Ltd. (421,298).—Private company. Capital £50,000 in £1 shares. Chemical manufacturers, distillers, gas makers, metallurgists, etc. Subscribers: P. H. N. Lewis; A. C. Hibbard. Solicitors: Middleton, Lewis & Clarke, 53 Leadenhall Street, E.C.3.

Chemical and Allied Stocks and Shares

STOCK markets have been dominated by the all-round advance in British Funds which followed Mr. Dalton's decision to redeem 3 per cent. Local Loans and replace the latter by a "tap" issue of 2½ per cent. Treasury bonds. Long-dated gilt-edged stocks led the advance, and other sections of markets have shown an upward adjustment of values. The rise, however, was not accompanied by any marked increase in the volume of business. Leading investments were adjusted upwards in price owing to the rise in gilt-edged, including the ordinary or equity shares of industrial companies. Home rails eased after their recent advance, but the prior charges moved higher again. Colliery shares responded to estimates of ultimate compensation values; but in some directions, notably Tube Investments, prices eased following news of the effects of steel shortages, although in such cases the tendency later became steadier on suggestions that the Ministry of Supply may agree to a revision of steel allocations.

Imperial Chemical at 42s., Dunlop Rubber at 69s. 9d., British Oxygen 95s. 7½d., and Lever & Unilever 49s. 3d. reflected the upward movement. Borax Consolidated deferred were good with an advance to 45s. 3d., the decision to pay the final dividend on the preferred ordinary shares at an earlier date this year having been taken as indicating confidence in the trend of the company's profits. Shares with bonus prospects (notably Vickers 10s. ordinary which advanced to 27s. 3d.) were favoured on hopes that the ban on share bonuses may be modified. Among colliery shares, which recorded a further all-round advance, Shipley were 44s. 9d., Staveley 58s., and Powell Duffryn 25s. 7½d. Steels were better, particularly Dorman Long, which rose to 26s., while United Steel strengthened to 25s. Colvilles were 25s., and Guest Keen 42s. 10½d. Babcock & Wilcox at 61s. 6d. xd responded to the good impression created by the unexpected increase in the interim dividend, while T. W. Ward moved up to 42s. 6d. in response to the victory bonus.

In other directions, the units of the Distillers Co. were prominent with an advance to 133s. United Molasses rose to 51s. 9d., and there was a rise to 65s. in Associated Cement. British Plaster Board were 32s. 6d., Radiation 55s. 7½d., and Metal Box shares strengthened to £5⅝, but following the news that the steel shortage has led to the closing of the works of a subsidiary, Tube Investments fell back to 3s. 1½d. to £6. Wall Paper Manufacturers deferred were 42s. 9d. following the higher dividend. General Refractories showed firmness at 19s. 3d., British Ropes 2s. 6d. shares were good at 11s., and various shares of other companies whose products are used in the heavy industries were favoured. Murex at 93s. 1½d. moved higher on the full results. Paint shares kept firm with Pinchin Johnson 45s., Goodlass Wall 29s. 4½d., and International Paint £6¾. Turner & Newall moved up to 84s. 6d. partly on higher dividend hopes. There was a general rise in textile shares under the lead of J. & P. Coats which advanced to 61s. 6d. Calico Printers were 24s. 6d., Bradford Dyers 23s. 1½d., and Bleachers 12s. 9d. British Celanese moved up to 32s. 9d. on further consideration of the past year's results, and Courtaulds were 52s. 6d.

Boots Drug went ahead to 58s. 9d., Beechams deferred were 25s. 9d., Sangers 32s. 3d., but elsewhere, Triplex Glass eased to 35s. awaiting the full results and chairman's annual statement. Fisons were 55s., W. J. Bush 90s., and Greeff-Chemicals Holdings 5s. shares 11s. 9d. De La Rue moved up to £12¼, and elsewhere Low Temperature Carbonisation 2s. shares rose further to 4s. 1½d. Oils failed to hold earlier gains, but Shell were 92s. 6d., and on higher dividend hopes Trinidad Leaseholds gained 5s. at 115s. 7½d.

Prices of British Chemical Products

THERE has been very little change during the past week in the London industrial chemical market, the chief interest being that of obtaining adequate supplies to meet a steady home demand and a sustained flow of inquiries for shipment. Production generally appears to be making progress under difficult conditions and contract deliveries have been well maintained, but the continued scarcity of spot offers in a number of directions has emphasised the tightness in the supply position. A good demand is reported for practically all the potash and soda products and the demand for lead oxides exceeds the available supplies. Firm price conditions have been maintained in the coal-tar products section and a good export market awaits material surplus to home requirements.

MANCHESTER.—The general run of industrial chemicals is finding a ready outlet on the Manchester market and the past week has seen a steady flow of new inquiries circulating from home consumers, with a fair number also, covering a fairly wide range of materials, from shippers. Contract deliveries of the alkalis, ammonia products, and mineral acids are being called for regularly, as well as many other compounds. Prices are strong in tendency in pretty well all directions. Fair buying interest is being displayed in superphosphates and one or two other sections of the fertiliser market, while in the tar products most lines are being taken up to the full extent of production.

GLASGOW.—Little change can be recorded in general conditions in the Scottish heavy chemical market during the past week. Deliveries against contract and orders for all classes of heavy chemicals have been well up to standard. The supply condition, however, show signs of deterioration and certain raw materials are exceedingly scarce. Prices show a marked tendency to rise, and generally the demand cannot be satisfied. Export inquiries and orders continue on a very brisk scale; considerable business has been noted in sulphuric acid, Glauber salts, sulphur, formaldehyde, copper sulphate, and tanning chemicals.

Price Changes

Rises: Arsenic; sodium chlorate; sodium nitrate; wood creosote; wood tar.

Falls: Calcium acetate; cream of tartar.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton, £47 10s.; 80% pure, 1 ton, £49 10s.; commercial glacial, 1 ton, £59; delivered buyers' premises in returnable barrels, £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r. MANCHESTER: £16 to £16 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER: £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—MANCHESTER: £40 per ton d/d.

Ammonium Carbonate.—£42 per ton d/d in 5 cwt. casks. MANCHESTER: Powder, £43 d/d.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £19 10s. per ton. See also Salammoniac.

Ammonium Persulphate.—MANCHESTER: £5 per cwt. d/d.

Antimony Oxide.—£120 to £123 per ton.

Arsenic.—Per ton, 99/100%, £38 6s. 3d. to £41 6s. 3d., according to quality, ex-store.

Barium Carbonate.—Precip., 4-ton lots, £19 per ton d/d; 2-ton lots, £19 5s. per ton. bag packing, ex works.

Barium Chloride.—98/100% prime white crystals, 4-ton lots, £19 10s. per ton, bag packing, ex works.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £18 15s. per ton d/d; 2-ton lots, £19 10s. per ton.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax.—Per ton for ton lots, in free 1-cwt. bags, carriage paid: Commercial, granulated, £30; crystals, £31; powdered, £31 10s.; extra fine powder, £32 10s. B.P., crystals, £39; powdered, £39 10s.; extra fine, £40 10s. Borax glass, per ton in free 1-cwt. waterproof paper-lined bags, for home trade only, carriage paid: lump, £77; powdered, £78.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial,

granulated, £52; crystals, £53; powdered, £54; extra fine powder, £56. B.P., crystals, £61; powder, £62; extra fine, £64.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£22 per ton, ex wharf. Granulated, £27 per ton.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5⅝d. per lb.

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Carbonate.—MANCHESTER: £8 15s. per cwt. d/d.

Copper Oxide.—Black, powdered, about 1s. 4½d. per lb.

Copper Sulphate.—£33 10s. per ton, f.o.b., less 2%, in 2 cwt. bags.

Cream of Tartar.—100 per cent., per cwt., from £12 14s. 6d. for 10-cwt. lots to £14 1s. per cwt. lots, d/d. Less than 1 cwt., 2s. 5½d. to 2s. 7½d. per lb. d/d.

Formaldehyde.—£27 to £28 10s. per ton in casks, according to quantity, d/d. MANCHESTER: £28.

Formic Acid.—85%, £54 per ton for ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1260 s.g., in tins, £4 16s. 6d. to £5 10s. 6d. per cwt., according to quantity; in drums, £4 2s. 6d. to £4 16s. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—11d. per lb. d/d, carboys extra and returnable.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d per lb., according to quantity.

Lactic Acid.—Pale tech., £60 per ton; dark tech., £53 per ton ex works; barrels returnable.

Lead Acetate.—White, 70s. to 75s. per cwt., according to quantity.

Lead Nitrate.—About £70 per ton d/d in casks. MANCHESTER: £70 to £72.

Lead, Red.—Basic prices per ton: Genuine dry red lead, £71; orange lead, £83. Ground in oil: Red, £92; orange, £104. Ready-mixed lead paint: Red, £99; orange, £111.

Lead, White.—Dry English, in 8-cwt. casks, £83 per ton. Ground in oil, English, in 5-cwt. casks, £102 per ton.

Litharge.—£68 10s. to £71 per ton, according to quantity.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £36 per ton.

Magnesium Chloride.—Solid (ex wharf), £27 10s. per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., for 2-cwt lots, 9s. 1d.; smaller quantities dearer.

Mercurous Chloride.—10s. 1d. to 10s. 7d. per lb., according to quantity

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d for lots of 7 to under 30 lb.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 3s. per gal.; pyridinised 64° O.P 100 gal., 3s. 1d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£100 to £105 per ton in ton lots packed in free 5-cwt. casks. MANCHESTER: £5 to £5 2s. 6d. per cwt.

Paraffin Wax.—Nominal.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £76 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate. — Crystals and granular, 7¼d. per lb.; ground, 8¾d. per lb., for not less than 6 cwt.; 1-cwt. lots, ¼d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £57 per ton for 5-ton lots, £57 10s. per ton for 1 to 5-ton lots, all ex store; hydrated, £51 per ton for 5-ton lots, £51 10s. for 1 to 5-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 8½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8d. per lb.; technical, £7 14s. 3d. to £8 6s. 3d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Salicylic Acid.—Manchester: 1s. 9d. to 2s. 1d. per lb. d/d.

Soda, Caustic. — Solid 76/77%; spot, £16 7s. 6d. per ton d/d.

Sodium Acetate.—£42 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 6½d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite. — Powder, 60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£45 to £47 per ton.

Sodium Hyposulphite.—Pea crystals 19s. per cwt. (ton lots); commercial, 1-ton lots, £17 per ton carriage paid. Packing free.

Sodium Iodide.—B.P., for not less than 28 lb., 10s. 2d. per lb.

Sodium Metaphosphate (Calgon).—11d. per lb. d/d.

Sodium Metasilicate.—£16 10s. per ton, d/d U.K. in ton lots.

Sodium Nitrite.—£23 per ton.

Sodium Percarbonate.—12½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £25 per ton d/d for ton lots. Tri-sodium, £27 10s. per ton d/d for ton lots (crystalline).

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salt).—£5 5s. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. Manchester: £4 12s. 6d. to £4 15s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot, £20 2s. 6d. per ton, d/d, in drums; crystals, 30/32%, £13 7s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £14 5s. to £16 10s., according to fineness.

Sulphuric Acid.—168° Tw., £6 2s. 8d. to £7 2s. 8d. per ton; 140° Tw., arsenic-free, £4 11s. per ton; 140° Tw., arsenious, £4 3s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—Per cwt., for 10 cwt. or more, £15 8s.; 5 to 10 cwt., £15 9s. 6d.; 2 to 5 cwt., £15 11s.; 1 to 2 cwt., £15 13s. Less than 1 cwt., 8s. 1d. to 8s. 8d. per lb. d/d, according to quantity.

Tin Oxide.—1 cwt. lots d/d £25 10s.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d; white seal, £54 5s.; green seal, £53 5s.; red seal, £51 15s.

Zinc Sulphate.—Tech., £25 per ton, carriage paid.

Rubber Chemicals

Antimony Sulphide.—Golden, 1s. 8½d. to 2s. 7½d. per lb. Crimson, 2s. 7½d. to 3s. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 8s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£37 to £41 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£44 to £49 per ton, according to quantity.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 10 5/16d to 1s. 5¾d. per lb.; dark, 10½d. to 1s. per lb.

Lithopone.—30%, £28 2s. 6d. per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Phosphate.—Imported material, 11% nitrogen, 48% phosphoric acid, per ton in 6-ton lots, d/d farmer's nearest station, in October, £19 19s. 6d., rising by 2s. 6d. per ton per month to March, 1947.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, in October, £9 15s. 6d., rising by 1s. 6d. per ton per month to March, 1947.

Calcium Cyanamide.—Nominal; supplies very scanty.

Concentrated Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. No. 1 grade, where available, £14 18s. 6d.

"Nitro Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £17 5s. per ton; granulated, over 98%, £16 per ton.

Coal Tar Products

Benzol.—Per gal. ex works: 90's, 2s. 6d.; pure, 2s. 8½d.; nitration grade, 2s. 10½d.

Carbolic Acid.—Crystals, 11¼d. per lb. Crude, 60's, 4s. 3d. MANCHESTER: Crystals, 9½d. to 11¼d. per lb., d/d; crude, 4s. 3d., naked, at works.

Creosote.—Home trade, 5¾d. to 8d. per gal., according to quality, f.o.r. maker's works. MANCHESTER, 6¼d. to 9¾d. per gal.

Cresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. MANCHESTER: Pale, 99/100%, 4s. 4d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £7 2s. 6d. to £10 per ton, according to m.p.; hot-pressed, £11 10s. to £12 10s. per ton, in bulk ex works; purified crystals, £25 15s. to £28 15s. per ton. Controlled prices.

Pitch.—Medium, soft, home trade, 75s. per ton f.o.r. suppliers' works; export trade, 120s. per ton f.o.b. suppliers' port. MANCHESTER: 77s. 6d. f.o.r.

Pyridine.—90/140°, 18s. per gal.; 90/160°, 14s. MANCHESTER: 14s. 6d. to 18s. 6d. per gal.

Toluol.—Pure, 3s. 1d. per gal.; 90's, 2s. 4d. per gal. MANCHESTER: Pure, 3s. 1d. per gal. naked

Xylol.—For 1000-gal. lots, 3s. 3½d. to 3s. 6d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £15 per ton; grey, £22.

Methyl Acetone.—40/50%, £56 to £60 per ton.

Wood Creosote.—Unrefined, from 3s. 6d. per gal., according to boiling range.

Wood Naphtha.—Miscible, 4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. to 6s. 6d. per gal.

Wood Tar.—£6 to £10 per ton.

Intermediates and Dyes (Prices Nominal)

***m*-Cresol** 98/100%.—Nominal.

***o*-Cresol** 30/31° C.—Nominal.

***p*-Cresol** 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb; 66/68° C., 1s.

***p*-Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

***o*-Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

***p*-Toluidine.**—2s. 2d. per lb., in casks.

***m*-Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON.—October 23.—For the period ending Nov. 2 (December 7 for refined oils), per ton, naked, ex mill, works or refinery, and subject to additional charges according to package: LINSEED OIL, crude, £135. RAPESEED OIL, crude, £91. COTTONSEED OIL, crude, £52 2s. 6d.; washed, £55 5s.; refined edible, £57; refined deodorised, £58. COCONUT OIL, crude, £49; refined deodorised £56; refined hardened deodorised, £60. PALM KERNEL OIL, crude, £48 10s.; refined deodorised, £56; refined hardened deodorised, £60. PALM OIL (per ton c.i.f.), in returnable casks, £42 5s.; in drums on loan, £41 15s.; in bulk £40 15s. GROUNDNUT OIL, crude, £56 10s.; refined deodorised, £58; refined hardened deodorised, £62. WHALE OIL, refined hardened, 42 deg., £89; refined hardened, 46/48 deg., £90. ACID OILS: Groundnut, £40; soya, £38; coconut and palm-kernel, £43 10s. ROSIN: Wood, 32s. to 45s.; gum, 44s. to 54s. per cwt., ex store, according to grade. TURPENTINE, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Chemical apparatus.—S. Adams. 28181.

Cyanoguanidines.—American Cyanamid Co. 27994-7.

Catalysts.—J. C. Arnold. (Standard Oil Development Co.) 28065.

Biguanide derivatives.—R. de B. Ashworth, F. H. S. Curd, J. A. Hendry, F. L. Rose, and I.C.I., Ltd. 27790.

Metal die casting.—Birmingham Aluminium Casting (1903), Co., Ltd., H. Fairbairn, and W A. Baker. 27968.

Weed-killers—Boots Pure Drug Co., Ltd., W. Howieson, W. F. Short, and H. A. Stevenson. 28146.

Organic compounds.—British Celanese, Ltd. 28238.

Cellulose derivatives.—British Celanese, Ltd. 28476-7.

Organic nitriles.—British Resin Products, Ltd., E. M. Evans, and H. Thurston-Hookway. 28116.

Methylpolysiloxanes.—British Thomson-Houston Co., Ltd. 28201.

Manufacture of salt from brine.—D. A. Crooks, T. R. Scott, and I.C.I., Ltd. 28227.

Quinoline derivatives.—F. H. S. Curd, J. K. Landquist, C. G. Raison, F. L. Rose, and I.C.I., Ltd. 27957.

Acetals.—Distillers Co., Ltd., P. L. Bramwyche, M. Mugdan, and H. M. Stanley. 28060.

Polymers.—Dominion Tar & Chemical Co., Ltd. 27893.

Polymeric materials.—E.I. Du Pont de Nemours & Co. 28229.

Butadienes.—E.I. Du Pont de Nemours & Co. 28230.

Interpolymers.—E.I. Du Pont de Nemours & Co. 28414.

Cyclohexenes.—E.I. Du Pont de Nemours & Co., and G. M. Whitman. 28228.

Filtering apparatus.—K. L. Ellila. 28472.

Dehydro-iso-androsterone.—Glidden Co. 27825.

Polyvinyl chloride sheets.—Greenwich Leathercloth Co., Ltd., and R. H. Czeczowitzka. 27898.

Aluminium alloys.—L. K. Gulton. 28459.

Aluminium compounds, etc.—E. A. E. Krause. 28455.

Thermochemical metal removal.—Linde Air Products Co. 28470.

Bonding aluminium alloys to steel.—Mallory Metallurgical Products, Ltd. 28121-2

Plastic material.—C. Nicolle. 28226.

Graphitic alloy steel.—Nitralloy Corporation. 28296.

Sodium sulphate.—P. Parrish. 28297.

Synthetic resins.—Soc. Générale des Huiles de Petrole. 28149.

Fibrous organic material.—Syntics, Ltd., and H. Hamburg. 28098.

Fumigating compositions.—J. Taylor, J. M. Holm, A. C. Hutchison, and I.C.I., Ltd. 27956.

Synthetic fibres.—Textile Machinery Corporation. 27958.

Soap products.—Thames Industries, Ltd., and A. Lewin. 27892.

Amino-ketones.—A. Wander, A.G. 28217.

Aqueous solutions.—A/B Centrallaboratorium. 28834.

Solutions of gas.—A/B Centrallaboratorium. 28835.

Acrylamide.—American Cyanamid Co. 28665.

Complete Specifications Open to Public Inspection

Monoalkamine ester-substituted pyrrole-3-carboxylic acid.—American Cyanamid Co. July 31, 1943. 12043/44.

Producing chemical compositions and products thereof.—American Cyanamid Co. March 24, 1945. 34023/45.

Organic compounds.—British Celanese, Ltd. March 20, 1945. 8342-3/46.

Manufacture of cupriferous disazo-dyestuffs.—Ciba, Ltd. March 22, 1945. 5014/46.

Manufacture of tetryl.—E.I. Du Pont de Nemours Co. Sept. 25, 1943. 9273/44.

Solutions of copolymers.—E.I. Du Pont de Nemours & Co. March 19, 1945. 8313/46.

Catalysts.—E.I. Du Pont de Nemours & Co. March 21, 1945. 8738/46.

Production of fluorohydrocarbons.—I.C.I., Ltd. March 21, 1945. 8739/46.

Deodorising seaweed and improving its flavour.—P. J. C. Margotton. March 22, 1945. 12902/46.

Producing rubber-like copolymers.—Mathieson Alkali Works. March 19, 1945. 2147/46.

Manufacture and use of resinous condensation products.—Monsanto Chemical Co. March 23, 1945. 9151/46.

Manufacture of corrosion resistant coatings for metals.—Rheem Research Products, Inc. March 21, 1945. 4565/46.

Manufacture of stabilised aqueous solutions of the alkali metal salts of 1-methyl-5-isopropyl-5-allyl-barbituric acid.—Roche Products, Ltd. March 22, 1945. 3920/46.

Production of anti-rust coatings on metals. —Soc. Continentale Parker. Oct. 23, 1940. 28303/45.

De-ironing of chromium ores.—Soc. d'Electro-Chimie, d'Electro-Métallurgie et des Aciéries Electriques d'Ugine. Dec. 13, 1943. 25118/46.

Catalytic dehydrogenation of hydrocarbons.—Standard Oil Development Co. Aug. 22, 1942. 10475/43.

Extrusion.—Aluminum Co. of America. March 31, 1945. 8478/45.

Refining method and apparatus.—Anderson, Clayton, & Co. March 27, 1945. 24562/45.

Temperature regulation of superheated vapour.—Babcock & Wilcox, Ltd. March 28, 1945. 9469/46.

Production of cellulose derivatives.—British Celanese, Ltd., March 30, 1945. 8937/46.

Production of heat sealable, transparent, cellulosic sheets and films.—British Cellophane, Ltd. March 27, 1945. 9213/45.

Organic condensation.—Dominion Tar & Chemical Co., Ltd. March 27, 1945. 25627/46.

Herbicidal compositions.—E.I. Du Pont de Nemours & Co. March 27, 1945. 25627/46.

Production of organic nitriles.—E.I. Du Pont de Nemours & Co. March 30, 1945. 9790/46.

Electro-winning of manganese.—Electro Manganese Corporation. Aug. 19, 1942. 16712/43.

Desulphurisation of vegetable foodstuffs. —J. M. L. Fabre. March 15, 1943. 25836/46.

Resin compositions and adhesives.—Firestone Tyre & Rubber Co. March 31, 1945. 9295/46.

Sedimentation device.—General American Transportation Corporation. March 26, 1945. 9088/46.

Complete Specifications Accepted

Production of thallium sulphide photoconductive cells.—J. Starkiewicz, R. L. Stow and C. S. Wright. Feb. 25, 1944. 580,550.

Tubular heat transfer apparatus, applicable to oil coolers.—Worcester Windshields & Casements, Ltd., H. Southall and T. M. Deakin. May 11, 1944. 580,652.

Tubular apparatus for cooling oil or other liquid.—Worcester Windshields & Casements, Ltd., H. Southall, and T. M. Deakin. May 11, 1944. 580,678.

Tubular heat transfer apparatus applicable to oil coolers.—Worcester Windshields & Casements, Ltd., H. Southall and T. M. Deakin. May 11, 1944. 580,679.

Refractory coating material.—H. H. York. Oct. 21, 1942. 580,541.

Nickel silicon alloy.—T. F. Bradbury. June 30, 1943. 580,686.

Manufacture of titanium pigments.—British Titan Products Co., Ltd., and R. W. Ancrum. July 27, 1943. 580,809.

Removal of stresses from thermoplastic resin articles.—C. H. Crooks, W. A. Greenwood, D. Starkie, H. Silber, and I.C.I., Ltd. Feb. 4, 1944. 580,855.

Manufacture of polyvinyl chloride.—P. W. Denny, and I.C.I., Ltd. Oct. 5, 1942. 580,731.

Manufacture of composite products of rubber and rayon and the products obtained thereby.—Dunlop Rubber Co., Ltd., and J. W. Illingworth. June 15, 1944. 580,776.

Titanium oxide pigment production.—E.I. Du Pont de Nemours & Co. Jan. 9, 1942. 580,734.

Enamel compositions suitable for application to aluminium and aluminium alloys.—E.I. Du Pont de Nemours & Co., and A. J. Deyrup. Aug. 13, 1943. 580,688.

Application of enamel compositions to aluminium base alloys.—E.I. Du Pont de Nemours & Co., A. J. Deyrup, and C. Robertson. Aug. 13, 1943. 580,689.

Manufacture of vinyl ethers.—W. J. R. Evans, and I.C.I., Ltd. Nov. 25, 1943. 580,748.

Manufacture of expanded thermoplastic materials.—Expanded Rubber Co., Ltd., and A. Cooper. Oct. 5, 1943. 580,743.

Reagent for testing for acetone.—A. Galat. July 19, 1944. 580,778.

Crystal contacts of which one element is silicon.—General Electric Co., Ltd., D. E. Jones, C. E. Ransley, J. W. Ryde, and S. V. Williams. May 6, 1942. 580,683.

Manufacture of compressed tablets and the like from finely divided ingredients.—Glaxo Laboratories, Ltd., and C. Creevy. May 11, 1944. 580,825.

Preservation of rubber or rubber-like materials.—B. F. Goodrich Co. July 15, 1942. 580,740.

Manufacture and use of plastic compositions.—W. T. Henley's Telegraph Works Co., Ltd., H. A. Tunstall, and W. F. O. Pollett. Feb. 5, 1942. 580,729.

Nitration of hexamine and hexamine dinitrate. H. R. Priston, and E. Roberts. July 15, 1940. 580,802.

Processes for thickening or solidifying liquid fuels, oils, hydrocarbons and the like and for preparing incendiary materials.—L. R. B. Shackleton. Sept. 16, 1942. 580,807.

Liquid fuel containers.—L. Shakesby, J. T. Watts, and I.C.I., Ltd. Jan. 10, 1944. 580,851.

Production of sheets and other shaped articles from disintegrated leather and/or other fibrous and/or finely divided materials and natural or synthetic rubbers.—W. F. Smith, H. Taylor, and I.C.I., Ltd. Sept. 29, 1943. 580,742.

Process for the manufacture of vat dyestuffs.—Soc. of Chemical Industry in Basle. Jan. 8, 1942. 580,681.

Catalytic conversion of hydrocarbon oils. Standard Oil Development Co. Dec. 27, 1941. 580,862.

Process for the conversion of hydrocarbon oils.—Standard Oil Development Co. Aug 12, 1942. 580,685.

Corrosion preventing compositions.—Standard Oil Development Co. Dec. 31, 1941. 580,845.

Method for the electrolytic preparation or concentration of heavy water.—L. Tronstad. July 27, 1944. 580,791.

Containers for liquid fuels.—J. T. Watts, L. Shakesby, and I.C.I., Ltd. March 23, 1945. 580,875.

Polarisers.—E. H. Wright. Feb. 28, 1945. 580,869.

Materials for producing plane-polarised light.—E. H. Wright. July 13, 1944. 580,870.

Manufacture of polystyrene.—L. Berger & Sons, Ltd., L. E. Wakeford, D. H. Hewitt, and F. Armitage. Nov. 3, 1944. 580,911.

Manufacture of interpolymers of styrene with polyhydric alcoholic mixed esters and of coating compositions obtained therefrom. —L. Berger & Sons, Ltd., L. E. Wakeford, D. H. Hewitt, and F. Armitage. Nov. 3, 1944. (Addition to 573,809.) 580,912.

Manufacture of interpolymers of styrene with frosting drying oils and of coating compositions obtained therefrom.—L. Berger & Sons, Ltd., L. E. Wakeford, D. H. Hewitt, and R. R. Davidson. Nov. 3, 1944. 580,913.

Bleaching organic acid esters of cellulose. —British Celanese, Ltd. July 27, 1943. 581,046.

Titanium dioxide pigments.—British Titan Products Co., Ltd., and R. W. Ancrum. Oct. 26, 1943. 581,008.

Heat treatment of metal plates.—Budd Induction Heating, Inc. Nov. 8, 1941. 580,976.

Centrifugal dust separating and collecting apparatus.—Buell Combustion Co., Ltd., and G. B. Tyler. July 28, 1941. 580,936.

Treatment of water.—Burgess Zeolite Co., Ltd. Sept. 21, 1942. 580,966.

Luminescent powders and methods of manufacturing such powders —Cinema Television, Ltd., K. A. R. Samson, and R. B. Head. June 15, 1944. 581,030.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

BOUVERIE HOUSE, 154 FLEET STREET, LONDON, E.C.4

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1427. November 2, 1946 Annual Subscription 21s. Overseas 26s.

Industrial Policy

BRITISH industrial policy, as we have pointed out on more than one occasion recently, has changed profoundly within the lifetime of the older men. Those who were in industry before 1914 can recollect the passing of the bad old order of the industrial revolution and the coming of a new order. The young men who were in industry before 1939 have experienced a change equally striking. It is perhaps a little early to be sure whether this change will be permanent or not. Nevertheless, change it is and industrialists must meet the new conditions. During the whole period between the two German wars, and even before that time, there was a surplus of man-power. The result was unemployment, often on a very large scale. A great part of this country's income was derived from foreign investment; consequently, whether we produced goods at home or not did not matter greatly from the point of view of our standard of living. We could buy from abroad what we could not produce at home. We could afford to neglect foreign markets—and we certainly did so. The change that has come upon us is connected with the change in our financial position. No longer have we any considerable investment abroad, and therefore we have little income from abroad.

On Other Pages

In order to maintain our pre-war standard of imports, we must export goods in volume at least 75 per cent greater than we did in pre-1939 years. That means that we must produce more per head of the population in order to do so. We require goods for our own use also; since we cannot afford to be lavish in our foreign purchases we must produce a greater proportion of the goods we use at home. One example may be given: before the 1939 war we imported 40,000 tons of dried lucerne for cattle feeding; to-day we are manufacturing equivalent cattle food from dried grass at a cost just half that which we paid for the imported product. We believe that that is typical of many industries.

On June 30, 1939, we had a total labour force of 19,750,000; on June 30, 1946, our force was 20,228,000. The future labour force is likely to be reduced slightly, rather than to increase. Military service and other causes are increasing the average age of those in employment. The immediate need is to increase productivity per man. Labour is demanding shorter working hours, with more pay. It is a natural demand, and from purely psychological aspects, it is a good movement; but it further reduces the available man-hours

that can be worked, though probably increasing the efficiency of the worker. There will thus be sharp limits to the number of workers that are available, and those numbers will become less by reason of the passing of time, the ageing of the population and the increased desire for leisure. War has expanded the chemical and engineering industries, and this fact has led to still further reductions in available man-power in many other industries. The need is thus not only for increased production per man, but also and especially per man-hour.

The solution to this problem may be found in better management. In any case the situation is a challenge not only to management but also to technical skill. It is common to declare that production per man-shift is declining, but this is only part of the story. There are many factories where it is increasing. Mr. Victor Collins, M.P., stated recently that in a factory in South Wales, by putting production on a 7-hour, 5-day week basis (35 hours a week), sufficient economies have been made to enable the weekly earnings of the labour force to equal those of a similar factory on a 47-hour week and the cost of the article to be reduced slightly. The difference in apparent wage cost through working shorter hours was more than compensated by improved efficiency in method and lay-out, and consequent improvement in the efficiency of the workers. Another example may be given in Mr. Collins's own words: " In one of my factories we have in eight months increased production more than 100 per cent with only 25 per cent increase in the labour force and a reduction from a 47 to a 44-hour working week. In this case the workers' earnings have increased, but the vital wage cost per article has lessened considerably."

Nor is this all. Increased efficiency leading to decreased working hours is not the only factor. There must be an incentive to the workers to give of their best. Not all workers regard shorter working hours as their ambition in life. There are those to whom increased earnings appeal still more; when the income tax rates are reduced to a reasonable figure that incentive will become still more important. There should be no upper limit on earning power. In the bad old days the management frowned on high earnings. If piece-rates gave weekly earnings that appeared to be much greater than the day-work wage, the management concluded that they had made a bad bargain and promptly reduced piece-work rates. That is the wrong attitude, as the U.S.A. has shown us. Let men earn as much as they can, provided the cost per article falls rather than rises. The greatest need to-day is for a fair distribution of the results of increased efficiency between all engaged in business or manufacturing industry, and this will be brought about best by complete co-operation between all concerned. In that way there lies the opportunity to increase production and decrease costs. The scientist and the engineer are key men in the new order which has now arisen. Let us see that they play their part—and receive their due share in what is achieved.

NOTES AND COMMENTS

The New White Slave Traffic

MUCH space has been given in the daily Press to reports of the removal of thousands of technicians and skilled workmen to Russia from Germany. In addition to these wholesale removals of Germans with their families, inventories are being taken of some of the factories, with a view to their dismantling and re-erection in Russia.. In the case of the skilled workmen at the famous Karl Zeiss factory at Jena, *The Times* correspondent says that no warning was given of the impending removals, which the Germans did not hesitate to describe as deportations. Lorries drove up at 4 o'clock one morning to the houses of the men selected for removal to Russia. The houses were surrounded by soldiers and sentries posted in the streets. A Russian officer with soldiers and an interpreter entered each house, and told the men they had three hours to get ready to leave for Russia. People who have seen the removals say that few of the German workers left willingly. Among those removed were two professors of Jena University. Russian controlled newspapers in Berlin intimated that a few German specialists have left for Russia " gladly and voluntarily," but they hint that the Russians are only doing, on a small scale,

what the Americans and British, they say, have already done wholesale.

Brockenhurst Explosion

NEWSPAPER reports of the recent fatal explosion at Brockenhurst railway station have in most instances failed to make clear that it was not the gas cylinders themselves which exploded, but that the cause was a leakage of gas not attributable to any defect of the apparatus as such. This is an important point which those concerned with the development of this form of heating would do well to impress upon the general public, who otherwise may become unduly apprehensive. At the inquest the Coroner recorded that the explosion was caused by gas from the cellar rising owing to a draught and forming with air an explosive mixture which came into contact with a gas-ring. He found there had been " slackness " in the changing of the cylinders, while evidence indicated that although the leakage had been reported, the gas had not been cleared. There has been no suggestion whatever that this case implies any inherent danger in the gas cylinder apparatus.

Safety Precautions

THE fact that the gas is an inflammable commodity should be patent to any consumer with common sense, but reputable distributors of the apparatus spare no pains to bring the possible danger to the notice of consumers. A representative of one of the leading firms told us of how they stress the " safety first " angle, not only to their own staff but to consumers through the dealers. Cards, headed "How to disconnect and connect ——— Gas Cylinders," giving detailed instructions with diagrams and including in bold red type in more than one place warnings as to the inflammability of the gas and the precautions essential, are supplied with every regulator, and dealers are instructed to affix them to every installation. It is the general practice, furthermore, for cylinders to be fitted and serviced by trained personnel, if consumers take advantage of facilities normally provided by distributors. In all the circumstances, therefore, it would seem that the present tragedy did not arise from a mechanical defect. It was apparently the inevitable human element at fault again.

U.S. Titanium Deposit

REPORTS from Arkansas are quoted by the *Daily Telegraph* as authority for the belief that " an apparently inexhaustible deposit of titanium discovered in that State more than two years ago will make the United States independent of other nations in the development of atomic energy." This statement obviously requires clarification. Titanium occurs plentifully in several mineral forms and is used in metallurgy, chiefly alloyed with other metals, for a number of purposes. Ferro-titanium alloys, for instance, are used as deoxidising agents and as oxygen and nitrogen scavengers, a small quantity of titanium being of advantage for the final purification of nearly all grades of steel. Titanium oxide is well-known, of course, as an excellent paint pigment. The precise relationship between the uses we have instanced and the development of atomic energy is somewhat difficult to understand, particularly when it is remembered that the atomic weight of titanium is 47.90.

Cupro-Nickel

INEVITABLY a good deal of intemperate criticism has been hurled at the scheme for replacing the silver coin of the realm by cupro-nickel pieces. Oddly enough, however, the heaviest barrage has come, not from the traditionalists who hate to see the silver disappear, but from the proponents of a coinage of pure nickel. The allegation is that the new currency will be, as Lord Balfour of Inchrye put it, " drab, dreary, utility coinage," and that the decision to use cupro-nickel would have a bad effect on the Empire. A more technical estimation of the position has been put forward by a working metallurgist, Mr. W. F. Brazener, managing director of The Mint, Birmingham, Ltd. (which is in no way controlled by the Royal Mint). He points out, in a letter to *The Times*, that the usual cupro-nickel coinage alloy consists of 75 per cent copper and 25 per cent nickel, and that coins properly manufactured from this alloy are neither drab nor dull, nor are they yellowish in appearance. They are not soft, they do not corrode easily, and they are as difficult to counterfeit as a pure nickel coin. The m.p. of 75/25 cupro-nickel is 1210°C., about 150° higher than that of the present quaternary silver alloy. Hardness of finished coins is 128 Vickers (D.P.) as against 132 for nickel, a trivial difference from the point

of view of durability. A 70/30 cupro-nickel to alloy was used extensively for Admiralty condenser systems because of its resistance to corrosion, and the same could be said of the 80/20 bullet-envelope alloy. Among the valid objections to the proposed new coinage is the argument that the use of only 25 per cent nickel will not go so far to take the place of the war-time demand for Canadian nickel as would the employment of a pure nickel coinage, while it is also suggested that objections may be raised in such places as the Sudan, where British silver coins are in circulation.

A Proud War Record

THE organisation controlled by Thos. W. Ward, Ltd., from their headquarters at Albion Works, Sheffield, is nation-wide, and the associate and subsidiary companies cover a multitude of occupations connected with the metallurgical and chemical industries. It is not to be wondered at, therefore, that they were called on to play an exciting and diversified part in the country's war work. Some account of this has now been published in the form of an attractively produced and well illustrated volume, entitled "End of a Chapter." Wisely, it does not set out to be a record of spectacular achievements, but is simply a day-to-day description of what had to be done and what was done—conditions which, to the credit of the companies concerned, approximated very closely to one another. The fact that this close approximation was the rule among our industrial firms during the war had an enormous amount to do, it will be admitted, with our ultimate success. Despite a wise insistence on the importance of the regular work, one or two "high spots" come in for a fair share of description. Such were the salving of the secrets of the *Graf Spee*, the construction of the underground aircraft factories, the repair of the Silvertown works after the visit of the Dorniers in September, 1940. Notable also are the illustrations of women at work on jobs which no one had thought them capable of doing, and of the tipping of a ladle of molten metal in Widnes Foundry.

A Sidelight on Ammonia

A GREAT many people have affectionate recollections of the work of Beatrix Potter, and *Peter Rabbit* and his junior colleagues have acquired well-established niches in the Hall of Literary Fame. Glancing the other day, however, through the recently-published Life* of this well-loved authoress, we were somewhat startled to come across a coloured representation of a Bunsen burner in full blast, attended by a learned and bespectacled Mouse engrossed in a chemical textbook; while a host of other mice are occupied in the background with a confused mass of test-tubes, rubber tubing, chemical balances, mortars, etc. We were somewhat relieved to find that our feeling of surprise had been shared by no less an authority than the late Sir Henry Roscoe, uncle of the artist, who had received the drawing as a gift from his accomplished niece. It should be explained that the drawing is entitled "A Dream of Toasted Cheese," and is in illustration of a statement, under the heading NH_3, in one of Sir Henry's own textbooks, to the effect that "the peculiar pungent smell of this compound is noticed if we heat a bit of CHEESE in a test-tube." We must confess that Miss Potter's vivid art has succeeded in portraying a mouse-professor who certainly looks as though he knew at least as much chemistry as many human professors whom we have encountered.

Aluminium Scrap

German Refined Method

A GERMAN filtration method for refining aluminium airplane scrap is described by American and British investigators as unique in metallurgy. The process is followed by a vacuum distillation, which produces aluminium suitable for re-use in all but the most critical aircraft parts.

The filtration method was used by I.G. Farben at Bitterfeld. The addition of an excess of molten magnesium to crudely refined melted scrap aluminium alloy was found to result in the formation of insoluble inter-metallic compounds of aluminium and magnesium with iron, manganese, silicon, chromium, vanadium, molybdenum, titanium, zirconium and cerium. These compounds could be filtered out as crystals when the mixture was cooled to near the point of solidification. The remaining mixture was heated in an atmosphere of hydrogen at a pressure of 2 mm of mercury in a closed furnace. By this means, all the remaining metals, except copper and small amounts of nickel and tin, were distilled out.

* THE TALE OF BEATRICE POTTER. By Margaret Lane (Frederick Warne; 12s. 6d.)

"The Inhibition of Corrosion"*

Measures for Indirect Fuel Saving

by W. F. GERRARD, A.R.I.C., M.Inst.F.

THE connection between corrosion of metals and fuel wastage may not be so obvious as that which exists, for example, between heat losses and boiler scale, but it is a very real one nevertheless. In fact, when the enormous quantity of fuel consumed in the manufacture of new equipment needed to replace that rendered prematurely useless by the ravages of corrosion is considered, the more subtle enemy may well prove to be the more formidable.

Evans[1] defines corrosion as "destruction by chemical or electro-chemical agencies" in contrast to erosion, which means "destruction by mechanical agencies." He quotes the rusting of iron as an instance of corrosion and the filing of iron as an example of erosion. Several writers have drawn attention to the identity existing between the products of corrosion and natural ores, and Watts[2] has aptly described corrosion as "a major industry in reverse—all loss and with never a profit." The elemental state is abhorrent to most metals, and iron, the most important of them all, will miss no opportunity to revert to the oxide or sulphide.

Corrosion Mechanisms

A clear appreciation of the fundamental corrosion processes is essential to the correct interpretation of a given case and greatly improves the chances of finding a satisfactory answer to the problems at issue. Even in dry air, freshly polished specimens of iron and steel quickly develop a surface film of oxide which slows down or "stifles" the conversion to oxide, though Vernon[3] has demonstrated that specimens continue to gain in weight owing to oxidation after months of exposure. Following a lead given by Vernon,[4] Murray[5] polished a number of specimens cut from the same piece of mild steel. Some of these were exposed directly to the laboratory atmosphere, while others were surrounded by a muslin cage. The method of suspension and other conditions were the same for all specimens.

Those in the "direct exposure" group rusted rapidly, but those protected from soot and dust particles remained bright for the duration of the experiment (three months). The muslin cage was then removed, but only slight tarnishing occurred during a further three months' exposure. The superior resistance of the protected specimens was attributed to the formation of a uniform oxide film over the surfaces. Finally, both sets of specimens were immersed in Liverpool town's water with deliberate aeration. Rusting continued apace on all specimens of the "direct exposure" group, but those which had been "cured" by protection in muslin were only attacked at the points of support where the oxide film was weak or ruptured.

A second experiment on the same plan employing improved suspension technique is in progress and it is already evident that a uniform film of oxide confers a high degree of protection against rusting, both in air and in water. Putting this conclusion in a more general way: the rate at which iron is corroded in air and in water is proportional to the rate at which oxygen reaches the surface of the metal.

Action of Acids

With this in mind, the action of acids is capable of a simple explanation. Iron oxide reacts with dilute hydrochloric, sulphuric, and hydrofluoric acids with production of the chloride, sulphate and fluoride of iron, all of which are soluble in water. Thus a fresh metallic surface is successively exposed, oxidised and dissolved, and so the cycle proceeds until the acid is exhausted or the specimen disappears. Lead resists sulphuric acid, siliver resists hydrochloric acid and magnesium, normally one of the most reactive of metals, withstands the action of hydrofluoric acid because lead sulphate, silver chloride, and magnesium fluoride are insoluble and take the place of oxide as protective films.[6]

Acids such as HCl and H_2SO_4 are present in small amounts in the atmosphere of industrial areas and in water supplies contaminated by waste liquors, but there is another impurity which, though its acid properties are less strongly marked, far outstrips them in importance because of its universal distribution in air and water. Carbon dioxide is produced by the respiraton of all animals, by decay of organic matter, and by combustion of any substance containing carbon. It is miscible in all proportions with air and so is ubiquitous in the atmosphere. If a sample of air were collected over the North Pole it would still be found to contain an appreciable amount of CO_2. Pure water has a neutral reaction, but when a trace of CO_2 is dissolved the water takes on a distinctly acid character. CO_2 is often called carbonic acid gas owing to the supposed formation of carbonic acid.

$$H_2O + CO_2 \rightarrow H_2CO_3.$$

* A paper read to the Conference on "Fuel and the Future" at the Central Hall, Westminster, on October 9.

Whether H_2CO_3 really exists as true chemical compound is of little moment, but the acidic reaction of CO_2 in water is a matter of the utmost significance. By its agency the film of oxide, which we have seen to be the main defence against corrosion of iron and steel, is converted into the relatively soluble carbonate which in turn decomposes into iron hydroxide and CO_2. The joint action of these two gases, oxygen and CO_2, is the commonest cause of general surface wastage, especially on iron and steel in contact with flowing water, which carries away the corrosion product (iron hydroxide) and is coloured red or reddish-brown in consequence. Sometimes the "red water" trouble is a greater nuisance than the corrosion problem itself. When the oxide film is constantly worn away by the scoring action of air, water or mechanical friction, so that the metal surface is continually exposed along a limited track, the result is popularly called "grooving."

Electro-Chemical Attack

Surface wastage, then, is a purely chemical process, but there is another and more dangerous form of attack due to electro-chemical causes and characterised by pitting. Differences in electrical potential on metallic surfaces can arise from a variety of causes, for example, if two dissimilar metals such as iron and copper are in close proximity, the salts dissolved in water may behave as conductors in an electric cell with copper as the cathode and iron as the anode. Reactions at the electrode surfaces will then result in solution of the iron and formation of alkali at the copper with precipitation of iron hydroxide at some intermediate place. Again, many metals, including iron, are anodic towards their own oxides and attack will be possible where the oxide film is weakened or broken.

A third type of electro-chemical corrosion occurs when the distribution of oxygen is unequal over a metal surface, the parts in contact with oxygen behaving as cathodes towards the unaerated parts. Activity of this kind is said to be due to differential aeration and is obviously liable to take place at or near water-line where the supply of oxygen is constantly replenished from the atmosphere, or at points in an installation where bubbles of oxygen can lurk, as at bends in pipe-lines. The theory of differential aeration accounts for the fierce corrosion which often goes on underneath a layer of scale, sludge, or paint when the metal nearby is exposed.

Underground installations in particular are subject to yet another type of electro-chemical corrosion by external e.m.f. When stray electric currents escape from tramways, electric railroads and power circuits generally, extensive damage may result because

(1) The rate of attack is independent of the rate of oxygen supply and is determined solely by the strength of the stray current.

(2) The corrosion products deposit at considerable distances from the site of attack and do not stifle the reaction.

(3) If there are breakages in any protective coatings applied the activity may merely be concentrated on a few places and bring about speedy perforation of the pipe or plate.

Hayman[7] mentions a case in which intense corrosion followed the leakage of current from a tramline to a gas main, thence to a water main, and finally back to another tramline. The British Post Office has devised special methods for dealing with difficulties brought about by the same kind of mechanism in telephone cable-sheaths.

Electrolysis can cause deterioration of metal-work above ground, notably when stray currents are passing in steel embedded in concrete which has been mixed with water of high salt content; in electrical equipment where insulation is faulty or the earthing unsatisfactory and on board ship where paint has been removed, *e.g.*, by friction while launching.[8] It need hardly be said that electro-chemical corrosion of all types is stimulated by contact between metals and sea-water, and it would be instructive to know, if that were possible, exactly how much fuel has been consumed in the construction of new ships and in repairs to hulls and replacements of propellers and condenser tubes necessitated for that one reason alone.

Graphitic Wastage and Impingement

We have not the space to discuss the many and diverse physical appearances exhibited by metals under the influence of corrosion. Nor is this necessary since they all spring from the same root causes, singly or in combination. A glossary of terms commonly used to describe the effects of corrosion is given in a recent paper by Turner.[9] Reference may usefully be made, however to the phenomena of graphitic wastage and impingement which may be responsible for failures of economiser tubes and turbine blades respectively. When cast iron undergoes graphitic wastage, the metal becomes anodic and is dissolved out by the water leaving a brittle skeleton of graphite. The dangerous feature is that the corrosion can escape notice if an inspection is perfunctory and sound metal may be thinned down to bursting point before it is detected. The protective oxide film on turbine blades is impaired by impingement from droplets of water travelling at high velocity and so corrosion is accelerated. Similar conditions can exist in condensers and in high pressure heating systems.

Prevention of Corrosion

The principal methods for prevention of corrosion all derive naturally from a study of the main corrosion mechanisms. They are designed primarily with one or more of the following objects in view:

(a) To consolidate and repair the protective oxide film.

(b) To replace the oxide film by another of greater durability.

(c) To eliminate the influences which might cause the breakdown of protective films.

(d) To neutralise an electrical condition which might lead to electrolysis.

(a) *Consolidation and repair of oxide films.*—The work of Vernon and Murray, *inter alia*, proves that the early environment of newly-fabricated equipment has a vital bearing on its subsequent resistance to corrosion. It should not be difficult to arrange for the "curing" of plant parts, piping and machinery in a dry, dust-free atmosphere until the oxide film is strong enough to stand fairly rough usage. There is scope for considerable research on this subject which should lead to a marked extension in the useful life of manufactured articles.

Small percentages of metals such as chromium and nickel when introduced to iron and steel, or aluminium to brass, promote a surface film of mixed oxides more closely grained in texture and more firmly adherent to the underlying metal, and when this can be done without detriment to the usefulness of the product in other directions an increase in the cost of manufacture may be well worth while. The aluminium brass which was produced by a team working under the direction of the late Guy Bengough must have saved the Admiralty enormous sums of money besides making it possible to keep warships in service for longer pediods. While we must take note of Turner's view[10] that there is no likelihood of a "cheap completely corrosion-resisting boiler steel," there still remains a very large potential field for alloy development in the fabrication of the heavier classes of industrial equipment.

The principle of mixed oxide film formation may be applied from the outside, so to speak, for the protection of metals in contact with water by treating the water with a soluble salt of a suitable metal. Perhaps the best known example is the use of chromate and dichromate for the inhibiton of corrosion of steel under water. It is believed that chromic oxide is deposited at anodic points by electro-chemical agency, and this carries out repair work at any weak places in the original iron oxide film.[11] There are widely different opinions as to the concentration of chromate required for this repair work, and Murray[12] has shown that much depends upon the initial cleanliness of the equipment to be protected. He has had satisfactory results at concentrations as low as 10 parts per million under favourable conditions and after effective detergent action, but it seems, for the present at any rate that the method must be largely confined to systems in which the water is re-circulated and that the chromate concentration must be much higher than 10 p.p.m. All authorities are agreed that chromate treatment is attended by certain risks and that the rate of corrosion may actually be faster if the salt content of the water is too high. It is a defence weapon to be employed with discretion by a competent practitioner.

Metallic Coatings

(b) *Protective coatings.*—Many kinds of protective coatings are employed for the treatment of steel structures and others are constantly under investigation. Among non-ferrous metallic coatings reference may be made to aluminium, cadmium, chromium, cobalt, copper, lead, nickel, silver, tin, and zinc, and the application processes include hot dipping, cementation, electroplating, metal spraying, and metal cladding. In America, rare metal plating is on the increase and tantalum especially seems to have a bright future for vessels used in the luxury trades, *e.g.*, perfumery, and cosmetics. Glass, rubber, and vulcanite linings also become more popular year by year. None of these artificial films and coverings have been entirely satisfactory for protection of metals throughout steam installations or other plant where water is passing at high temperature and pressure and where thermal stresses may be severe. Graphite paint and cement washes have been applied with a fair measure of success to water distribution pipes, storage tanks, internal surfaces of boiler drums, and other accessible parts. It is imperative that any protective coating should be uniform otherwise intense local attack is likely, and, as a corollary, the surface to be protected must be reasonably clean and free from corrosion products before the coating is put on.

(c) *De-aeration and elimination of corrosive impurities.*—We have seen that the affinity of iron for oxygen is the ultimate cause of corrosion in nearly all cases, and it follows that if oxygen is eliminated from the environment the metal will remain unchanged almost indefinitely. This approach is manifestly impracticable for the protection of structures in air or underground, but the removal of oxygen from water can be accomplished either by mechanical or by chemical processes, and is perhaps the most positive step that could be taken for the inhibition of corrosion in

steam plant. The modern mechanical de-aerator is an extremely efficient piece of apparatus; it has been described in detail in *The Steam Engineer*[13] by the present author. For large water consumers mechanical de-aeration is the answer *par excellence*, but the smaller plant owner may not be able to afford the capital cost or to justify it in relation to the magnitude of his corrosion problem. Sodium sulphite can be employed as the sole agent for oxygen removal, but has the following serious disadvantages. Skilled control and frequent testing are essential in order to cater for variation in oxygen content; the method is expensive when dealing with raw water fully saturated with oxygen; dosing arrangements must be effective and reliable and the period of residence after the addition of sulphite must be long enough to allow the reaction to go to completion. This usually means plant of some kind. Certain metallic salts, *e.g.*, manganese sulphate when added in very small quantities, accelerate the absorption process, but even with their assistance the author considers that the period of residence should not be less than 30 min. when O_2 exceeds ·1-ml. per litre; addition of sulphite increases the total solids of the feed water which involves a corresponding increase in the percentage blowdown from boilers in order to keep the density within permissible limits. As an example, water saturated with oxygen demands $\frac{3}{4}$ lb. of sulphite per 1000 gal., which would increase the total solids of Glasgow water by more than 100 per cent.

Influence of Acids

Other oxygen absorbents have been proposed and claims have been put forward by many writers, *e.g.*, by Fager and Reynolds,[14] for the absorption value of alkaline tannates, but sodium sulphite still retains pride of place for this purpose. The adverse influence of acids in general, and of carbon dioxide in particular, can be offset in water-carrying installations by the maintenance of a slight but definite alkalinity, and by control of *p*H value.

Although CO_2 is the only acidic impurity found in all natural waters, others occur locally. Sulphuric acid is fairly frequent in mine drainage water through contact with pyritic seams, and strong mineral acids are often discharged as waste liquors into rivers and canals. In industrial districts traces of sulphur gases can be picked up from the atmosphere. Moorland supplies contain organic acids and so does the effluent from sewage disposal works. Hence, it is no exaggeration to say that the first duty of every water treatment chemist is to make sure that a slight but definite alkalinity of the right kind is maintained at all times. The alkaline reaction must be definite in order to prove that the acids have been destroyed and to allow a reasonable margin for experimental error in making the test and variation in raw water quality before the next test is due. It must be slight because excess alkalinity is undesirable in many industrial processes, and particularly in steam generation. Twenty to 50 p.p.m. of alkalinity expressed as $CaCO_3$ is widely accepted as a practical working standard. The alkalinity must be of the right kind in order to neutralise acid tendencies arising from the breakdown of bicarbonates when the water is heated. Obviously any alkali which is liable to decompose and produce an acid at high temperature would not be suitable as an anti-corrision treatment for steam plant. The reasons for preferring one alkali to another for specific purposes are closely connected with questions other than corrosion which are outside the scope of the present paper.

The touchstone by which one decides whether alkalinity in boiler feed water is of the right kind or not is the test for *p*H value. If the *p*H is above a certain critical value there are sound reasons for expecting immunity from attack from CO_2. The symbol "*p*H" stands for "the logarithm of the reciprocal of the hydrogen ion concentration." Hydrogen ions are characteristic of acids and low *p*H indicates a strongly acid tendency. In water, the perfect neutral compound, hydrogen ions are exactly balanced by hydroxyl ions and the "strength of alkalinity" could be expressed in terms of the hydroxyl ion concentration. But since the hydroxyl ion concentration must necessarily be inversely proportional to the hydrogen ion concentration, it is more convenient to express both acidity and alkalinity in terms of one kind of ion. It is important to bear in mind that *p*H value does not measure the total acidity or total alkalinity, but merely the number of free H ions in solution. It is an indication of intensity rather than quantity, the relation being much the same as that between temperature and heat, or between voltage and electrical energy.

Aggressive CO2

*p*H control for prevention of corrosion was put on a quantitative scientific basis by Langelier[15] and De Martini.[16] They classified CO_2 in water supplies as being of four kinds: CO_2 permanently combined as carbonate; CO_2 temporarily combined as bicarbonate; CO_2 required to stabilise bicarbonates in solution; excess CO_2 over and above these.

Only the fourth kind, they said, is active or aggressive CO_2, and Langelier proposed an elementary test to show whether CO_2 of the last kind is present or not. The *p*H value of the water is tested before and after stirring with powdered chalk. If the *p*H of the raw water is increased by the

addition of chalk, Langelier's Index has a negative value equal to the difference between the two results, and the water is corrosive in correspondng measure. Conversely, if the pH value is reduced by the addition of chalk, the index is positive and the water is assumed to be non-corrosive—*e.g.*:

*p*H raw water	*p*H after stirring with $CaCO_3$	Langelier's Index	Character of water
6.5	8.0	—1.5	Corrosive
7.8	7.5	+0.3	Non-corrosive

Langelier points out that when his index is positive, any tendency towards galvanic action must result in the deposition of the $CaCO_3$ at anodic points; thus the theory takes into account to some extent the old carbonic acid cycle and the newer theory of D.A. as well as the principles of protective film formation and neutralisation of acids.

In my view the index can be usefully employed in the control of treatment for cold water circuits, but in parts of the plant where *p*H is constantly changing due to loss of CO_2 decomposition of bicarbonates and precipitation of Ca and Mg ions, it is easier and safer to ensure that the *p*H is high enough to satisfy Langelier's hypothesis under the most severe condition which could possibly arise in the plant, and, that being so, all one needs to do is to arrange that the *p*H never falls below 9.0. The prospect of $CaCO_3$ forming a protective scale seems to disappear when phosphate conditioning is in force, and no form of *p*H control can be relied upon to stop attack by dissolved oxygen.

Colloidal Preventives

Other inhibitive measures for treatment of water to prevent corrosion besides those mentioned above include the use of colloidal substances such as starch and silicate of soda. It is known that colloids have a high adsorption capacity for gases owing to the enormous surface area presented by particles of sub-microscopic size, but the method is somewhat uncertain, and a more direct attack on the problem such as that offered by de-aeration and removal of CO_2 by treatment with lime is preferred when practicable.

(d) *Prevention of electrolysis.*—Although corrosion of steel by electrolysis is possible on above-ground structure, it is a more serious problem in connection with underground pipe-lines and cables. Not only is the likelihood of picking up stray currents far greater and opportunity for inspection much more restricted, but the acids present in many types of soil often cause extensive deterioration of insulating material, protective coating and wrappings. Attack is then intensified at the weak spots. Insulation is usually attempted by dipping the pipe in bitumen, coal tar or cement, by coating with zinc by the dip or spray process and by wrapping with various materials impregnated with tar or asphalt. Insulating joints have been employed with striking success by the British Post Office. The method of jointing for protection of pipes has been described by Steinrath and Klas[17] and for cable sheaths by Radley and Richards.[18] The method is a long way from foolproof, and if the number of joints is inadequate or if they are wrongly situated, defects may be multiplied by the creation of anodes and cathodes on each side of the break (Evans[19]).

Sacrificial Anodes

The use of sacrificial anodes has been described by Jeavons and Pinnock.[20] Numerous iron bars sunk in the ground in moist places (specially prepared if need be) were connected to the pipe-line after taking precautions to ensure good electrical contact between the sections over the entire lengtth of pipe. Particular care was exercised to make the covering as perfect as possible. The iron bars thus became the true anodes of the system and suffered rapid corrosion, but the pipe was preserved in excellent condition. In passing we may note that the idea of sacrificial anodes is a very old one—it is at least as old as the use of zinc plates in boilers! The most modern method of combating electrolysis in underground pipe-lines and one which appears to present the possibility of wider application than any other so far proposed, is known as cathodic protection. Schneider[21] has given a most instructive and enlightening account of the process from which the following passage is quoted: "Cathodic protection protects a pipe by sending an electric current from an outside source to the pipe through the weak spot in the pipe wrapping or to the surface of the bare pipe, neutralising the electric currents that previously discharged from the surface and caused corrosion.

"To protect a pipe or other structure cathodically the compensating current must be caused to enter the pipe through the soil. This is accomplished by connecting a source of direct current, to cause a current to flow from the auxiliary electrode, pilot pipe or anode, to the main being protected. When the adjustments of the protective current are properly made, all corrosion of the pipe-line in the area is completely prevented. The corrosion that previously took place on the main line has been transferred to the ground electrode. Preliminary tests are made to determine the capacity of the direct current supply required to protect a given line. The source of current for this test current is usually a portable storage battery, a portable gasoline engine-driven direct-current

generator or a portable welding generator. If a convenient source of power is available a temporary motor generator set or a rectifier installation can be used.

"The positive terminal of the battery or other source of direct current is connected to a temporary low-resisance ground through an ammeter and a rheostat. The negative terminal is connected to the pipe to be protected. Holding the current at a constant value during the test, soil current readings are taken at several points and at the limits of the positive or corroding portion of the pipe-line. In the positive areas the soil current will be found to be reduced or even reversed if the protective current is great enough. It is desirable to repeat this test for several values of battery current.

"When the earth current readings are plotted at a given location against the battery output a nearly straight line will be obtained. This is used to determine the value of protective current required. The value of protective soil current required, in milliamperes per sq. ft. of pipe surface, as indicated by the McCollum earth-current meter, can be determined approximately from the empirical equation:

$$i = \frac{1000}{r}$$

in which

i = current in milliamperes picked up by pipe per sq. ft. of surface exposed to soil;

r = specific resistance of soil in ohms per cc., as given by Shepard rod, McCollum meter or laboratory test with a-c. bridge

1000 = constant, including a safety factor of three, found in laboratory tests on sheet steel. The safety factor compensates for inequalities in the steel, differential aeration, contact with other elements in the soil, such as coke, metallic areas, etc.

"The advantage of this equation is that it requires few or no additional tests to obtain the necessary information on which to determine the minimum current required, and is convenient and sufficiently accurate for practical field use."

Schneider stresses that electrolysis occurs only at points where current can escape from the pipe and that entering currents actually protect a metal at the points of entry. The signal advantage is claimed that by cathodic protection defects in the ordinary coating and insulators can be overcome without excavation of the line, an expensive and inconvenient operation under concrete pavements in busy city streets.

Conclusion

Corrosion and its prevention is a science in itself, and it would be idle to pretend that we have done more than to survey the subject very briefly in this paper. The object has been not so much to study any single aspect in detail as to show that methods are in existence to deal effectively with almost every corrosion problem. It is hoped that the industrial public, perceiving the broad outline of prevention technique and appreciating the intimate relation between corrosion mechanisms and protective measures, will gain confidence in the ability of the experts to solve its problems and will recognise that money spent in carrying expert advice into practice will, in most instances, be regained many times over.

As it becomes more widely realised that protection is cheaper than replacement, the amount of fuel consumed in new manufactures, repairs, and maintenance, or wasted by avoidable stoppages will be reduced and so the nation will gain while the individual helps himself. If it is true as Watt states that corrosion results only in loss and never in profit, then surely the converse likewise holds good with reference to corrosion prevention.

The author recorded his indebtedness to various experts for advice and information.

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Metallurgical Section

Published the first Saturday in the month

Metallurgical Section

November 2, 1946

American Research on Germanium

Important Commercial Uses Found

by WILLIAM BULL

PRODUCTION on a commercial scale of the metal germanium and its dioxide is one recent application of research in the U.S.A. Costs have been notably reduced as a consequence of the investigations at the Battelle Memorial Research Institute in conjunction with the work of E. W. McMullen, Director of Research at the Eagle-Picher Lead Company's Research Laboratories. The future applications of germanium promise important developments, but large supplies will not be available in the near future, as although the metal was produced a month ago in commercial quantities, this was largely preempted.

Germanium is less refractory than silicon, is intermediate between silicon and tin in alloying facility, while glasses containing the dioxide possess greater refractivity, dispersion, and density, lower softening points, and greater viscosity than those with SiO_2. Demand for germanium arises from its applications to radar, from its exceptional properties as applied to design of film resistors and from the remarkable character of two notable alloys which expand slightly on cooling with consequent application to small-scale precision casting, *e.g.*, the use of the binary Au-Ge eutectic in dental inlay work. Now, thanks to the development of a method of production on a larger scale, it is likely that the industrial sphere of germanium will be progressively developed. A Société Française Radio-Electrique patent of August, 1939, for example, relates to a cathode material, containing 74 per cent Al, 21 Ge, 2 Fe, 3 Si, useful for electron tubes because of its strong secondary emission of electrons, while a U.S. patent of January, 1929, enters the sphere of germanium high-restivity film deposit in Pyrex or dense ceramic tube resistors. Recently in this field of high-restivity germanium films the Battelle Institute has worked out a method by which the films, to gauged amount and even distribution along tube interiors, can be systematically duplicated.

Film Deposition Methods

Film-deposition methods are interesting and comparatively simple and can be accomplished by passing germanium hydride in gaseous form, resulting from temperature applications about 370° C., through tubes of appropriate material. A mixture of 30 to 50 per cent of GeH_4 is prepared by treating magnesium germanide (made by heating two parts magnesium filings with three parts germanium powder to red heat in a hydrogen atmosphere) with dilute HCl. The deposition on glass, for instance, according to the Battelle method, follows by admitting definite amounts of a hydride-hydrogen mixture into the evacuated tubes. The tubes are then evenly heated to 400-450° C. at the film-deposition location, when a silvery grey film then appears. Concentrations of 25 per cent hydride to 75 per cent hydrogen are recommended; higher percent-

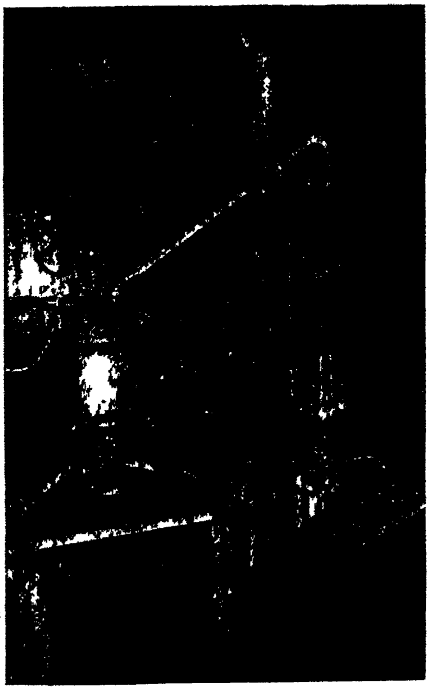

Fig. 1. Germanium recovery plant in the Eagle-Picher research laboratories.

ages of GeH_4 furnish a deposit liable to flake. The Pyrex tubes are heated as described for 10-25 minutes, an adherent uniform film resulting.

Germanium film resistors possess exceptionally high resistivity, measured over a 2.5 cm. length of 7 mm. Pyrex tubing. Resistances range from 1000 ohms upwards, according to deposition conditions, while temperature coefficients vary only from 0.001 to 0.003/1° C., even lower temperature coefficients are obtained with silvered tubes. Germanium and silicon as semi-conductors have rectifying characteristics, and research on germanium applied to radar rectification of micro-waves has, during the war, been intensively carried out at Purdue University. The Cornelius germanium-crystal rectifier, type IN34, will, it is claimed, permit higher inverse peak voltages, thus a potential field of use is envisaged in voltage regulators, low frequency oscillators and polarising apparatus. In this rectifier a tungsten wire is in contact with low-tin germanium alloy wafers, 0.015 in. thick.

Other applications of germanium, as distinct from certain rather important alloys, possess points of interest, but at this stage seem unlikely to assume industrial importance. Sources of Ge include germanite, found in S.W. Africa, but this sulphide, containing 6 per cent Ge, was reported to be "depleted" in 1942. The oxide is known to occur in Britain and Russia to around 1 per cent in coal ash and flue dust and it is noted that this could be an adequate source of supply if extraction costs could be justified. Extraction of germanium is usual through distillation of $GeCl_4$, obtained by treating ground ores or residues with HCl, the resultant tetrachloride is hydrolised to GeO_2, filtered out and ignited. Reduction to the metal is complicated by the fact that the use of molten chloride fluxes is necessary to avoid loss through the volatile GeO. There are other methods, but that reported as preferable is reduction to fused mass by carbon, or cyanide and carbon, under molten sodium chloride flux; oxide or oxygen is present, and elimination is by repeated melting and freezing in hydrogen, or by vacuum treatment while molten.

The Eagle-Picher Company, which developed the industrial scale process in response to radar demands, are reported to be the world's largest producers to-day. Their prices, in U.S.A., were recently 50 dollars a pound for the oxide and 180 dollars a pound for the metal. This company's maximum production is around 2,000 lb. yearly, governed by the amount of cadmium residues becoming available from their plant.

Recovery at the Eagle-Picher plant is a particularly interesting industrial process, developed during the war period and the result of considerable research. Mr. McMullen is the company's Director of Research and the writer is indebted to him for the photo-

Fig. 2. Henryetta cadmium recovery plant of the Eagle-Picher Co.

graphs taken especially to illustrate this article. Spectroscopic analyses revealed that germanium was concentrated in the fume produced in sintering zinc concentrates. At the Cadmium Recovery Plant, this fume is dissolved in sulphuric acid and cadmium is separated from other metals. Through spectroscopic analyses the greater part of the germanium can be concentrated in specific residues. The prepared residue is then forwarded to the Joplin Research Laboratory, it is here distilled with excess strong (at least 31 per cent HCl) acid. The distillate, volatile $GeCl_4$ and chlorides of certain other metals, are collected in ice-cooled containers. A subsequent somewhat complicated treatment of the tetrachloride results eventually in a pure, water white, spectroscopically pure tetrachloride. Germanium hydroxide is then produced by hydrolysis. One volume $GeCL_4$ is diluted to five volumes by ammonia solution and hydroxide is precipitated in the next twenty-four hours. It is then washed, filtered and dried at 150° C. to form the dioxide. Reduction of the dioxide with sodium cyanide, and carbon, at 1200°C. gives a 99.6 per cent purity, or by hydrogen at 900° C., when a high laboratory degree of purity is required.

Certain alloys, notably gold-germanium and copper-gold-germanium eutectics appear to possess important characteristics. Wide investigations into the various systems, including gold-germanium ternaries, have been made, and efficient applications of the Au-Cu-Ge alloys include soldering of gold base alloys, using standard fluxes and heating treatments. These alloys, which expand slightly on cooling, possess a hardness of 200-300 v.p.n. and strength of around 55,000 lb. per sq. in. Germanium does not react with carbon so that it may be melted in graphite crucibles and the gold —12 per cent germanium eutectic, of a gold colour, has the low melting point of 356° C., exceptional qualities for precision casting and excellent soldering propensities for gold alloys or gold plated articles. Silicon provides a similar alloy but is extremely difficult to dissolve in molten gold, moreover the Au-Si eutectic, owing to easy drossing, is difficult to handle in soldering. The binary alloys are of fine micro-structure and, up to 92 per cent gold, expand on solidification and even at this percentage will crack glass containers on cooling. This property is valuable; for example, an experimental dental inlay, made without the customary correction for shrinkage, has, without detectable corrosion or other disability, been in personal service now for somewhat more than a year.

The main points of present commercial or industrial application have been outlined here, but further investigation may reveal other developments in sources, production and processes of germanium or its dioxide.

C

Iron and Steel Output

U.K. Figures for September

THE production of both pig iron and steel in the U.K. during September was at a higher rate than during August, according to figures issued by the Ministry of Supply, although steel production was curtailed because of a Scottish labour dispute which involved furnace bricklayers. The tables below show how the position compares with last year, all figures representing tons:

PIG IRON

	1945 Weekly average	1946 Weekly average
First quarter	134,500	145,500
Second quarter	132,600	150,500
Third quarter	132,600	146,600
August	122,300	145,300
September	139,800	147,300

STEEL INGOTS AND CASTINGS

	1945 Weekly average	1946 Weekly average
First quarter	233,200	242,600
Second quarter	227,200	252,100
Third quarter	211,300	230,000
August	182,000	225,900
September	240,700	238,500

Scottish Minerals

Resources for a Light Alloy Industry

LAST week, in a paper on "The Industrial Development and Rehabilitation of the Highlands," read to the members of the Town and Country Planning Association (Scottish Section) at their conference at Dunblane, Dr. G. D. Muir, F.R.I.C., chairman of the Scottish Area Committee of the A.Sc.W., said that limestone and dolomite deposits in the Highlands could be transformed on the spot into such useful products as synthetic rubber, plastics, fertilisers, and light metals. Limestone was one of the chief mineral resources of the Highlands, while the 300,000,000 tons of high-grade dolomite lying around Durness and Loch Eriboll, in Sutherland, provided a source of magnesium.

There were sound technical reasons, he said, for establishing ferrosilicon and magnesium industries in the Cromarty Firth area. Power could be supplied from Ross and Cromarty hydro-electric stations, while existing aluminium plants in Inverness-shire could supply aluminium to facilitate developing a light alloy industry.

A sum of £830,000 is to be spent on development plans in Basutoland within the next ten years.

Training of Good Metallurgists

Dr. T. Wright's Presidential Address at Birmingham

"THE University Training of a Metallurgist" was the title of the presidential address which Dr. T. Wright gave to Birmingham Metallurgical Society on October 24, after he had been inducted president by the immediate past-president, Dr. J. W. Jenkin, to whom Dr. Wright presented the silver medal of the society.

In his address, Dr. Wright, who is a Lecturer in Metallurgy at Birmingham University, recognised that, however balanced a university course might be, it was a compromise in the sense that the field covered could be a small part only of the subject. He said a university had to train men for a wide variety of jobs between the extremes of works management and pure research in the laboratory. In the past one single comprehensive course trained a man for both production and research, but the type of research for which he was equipped was restricted mainly to that concerned with industrial problems.

There was no commercial organisation which clamoured for men trained to do research on problems of a fundamental scientific nature but there was a real need for such men if the nation was to keep in the forefront of scientific development. Industry gained in the long run from discoveries of a purely scientific nature. When atomic energy became available as a source of power for industry and mankind in general it would be as a result of the work of pure scientists.

The Department of Metallurgy in Birmingham University now provided a comprehensive course for training research workers in metal physics, or theoretical metallurgy. It was a new venture and he believed that Birmingham was, as yet, the only university to offer such a course. A parallel specialised course in industrial metallurgy had also been inaugurated in Birmingham to cater for that larger group of students wishing to follow a more orthodox metallurgical career. This new venture offered a training for industry far more adequate than when one course fulfilled a dual role. The industrial course, in which students learned something of the economic side and works organisation, must be regarded as the more important.

The student's first year was a general preparation in the pure sciences. He then studied metallurgy for two years; and specialised in his final year either as a theoretical or an industrial metallurgist. The final stage for the latter must be in the works which employed him. Dr. Wright showed how practical work was extended to industrial production processes during vacations and by visits to works, for which they were grateful to industry. The new Department of Industrial Metallurgy would be equipped with plant enabling students to handle metals on a scale more comparable with industrial operations.

Referring to essential subjects outside metallurgy—physics, chemistry and mathematics—Dr. Wright said: "The type of metallurgical training now necessary demands a much higher intellectual standard in the student than it has in the past. To be able to make the grade in the new courses at Birmingham he must be equal to the best type entering for degrees in physics or mathematics. One of our greatest difficulties will be to attract sufficient young men of high mental calibre. It is natural that when a boy comes to the university he prefers to study a subject with which he is familiar. An hour's talk by some suitable person to senior boys before leaving school could do a great deal towards introducing the fascination of the subject and its possibilities as a career."

A broader cultural education would increase the technical specialists' usefulness to the community and their own personal enjoyment of life, but it must be voluntary. Employers preferred metallurgists to be "good mixers" and that, though inherent in personality, could be fostered in the university. Associated with it was the knack of winning the confidence, respect and co-operation of workmen.

NON-FERROUS SCRAP

The Ministry of Supply states that the Government's stock of non-ferrous scrap metals on charge on September 30 totalled 183,752 tons, made up as follows: Q.F. cases muffled S.A.A., 85,658 tons; ingots, 17,993; lead and lead alloy, 1503; copper and copper alloy, 20,082; zinc and zinc alloy, 12,666 tons other grades, 45,850. Sales for August and September amounted to 18,286 tons (approximate value £910,000).

COPPER CONSUMPTION

U.K. output of main copper and copper alloy products in September was 53,954 tons, of which copper content of output was 42,510 tons Output of unalloyed copper was 24,097 tons, alloyed copper 26,121 tons, and copper sulphate 3736 tons.

Fuel Saving in Metal Making*

Diverse Operation Methods

by LESLIE AITCHISON, D.Met., B.Sc., F.R.I.C., F.R.Ae.S.†

NON FERROUS metals, and still more the light alloys, do not call for particularly high temperatures in the course of their fabrication. Copper with a melting point of 1084°C. or aluminium, melting at 657°C., indicate the order, and even allowing for a reasonable measure of superheat the highest temperatures ever likely to be employed during the manufacture of these metals and their alloys are considerably below those needed in the melting—or even the forging—of steel. This fact widens the fuel possibilities considerably. It makes the choice of fuel easier, in many respects, for the brass founder than for the steel maker. It may even be admtted that the non-ferrous manufacturer has been able to "make do" with fuels of a lower grade than his ferrous brother—though not necessarily to his advantage. More importantly, though, his lower temperature requirement means that in most cases the amount of fuel used in a comparative operation is likely to be considerably less for the non-ferrous and light metals than for cast iron or steel.

Comparative Fuel Costs

A second point having an important bearing—at any rate on the psychology of the matter—is that the non-ferrous metals and the light alloys are all metals of a relatively high money value as compared with iron and most steels. Taking virgin metals alone, the mixture prices on to-day's markets for 60/40 brass, 70/30 brass, gilding metal, and duralumin are respectively £67, £71, £80, £75 per ton, as compared with £8 15s. per ton for pig iron. When these values for the non-ferrous metals are compared with the price of the fuel required to melt them and a similar calculation made for pig-iron—and of converting the iron into steel—the disparity becomes very obvious and indicates that as an item in the fabricating bill fuel pays a much smaller rôle in the non-ferrous than in the ferrous world. Nevertheless, it must not be inferred that fuel economy is of but little importance to the manufacturer of non-ferrous metals.

A third aspect deserving of mention is that of scale of operation. For a variety of reasons the range in the size of melting furnaces is quite extensive. In a copper refinery the melting unit is large, and, for certain purposes, brass can be handled in big masses—up to 20 tons for a furnace charge. But such installations are by no means general in the trade, due to its particular nature, and a great many fabricating concerns melt their alloys in furnaces of quite small tonnage capacity. The employment of electric melting, particularly in the low-frequency induction furnace, bringing with it advantages in handling, cleanliness, and quality, has made the melting unit in popular use rather small—not more than about a ton, and many firms concerned with quite a considerable output of copper alloys produce their castings by a multiplication of units of modest dimensions rather than by installing fewer units of large capacity. The position is not quite the same for the light alloys, and for wrought manufacture large furnaces are quite generally used—of, say, 10 or 12 tons capacity. It is rather early yet to say whether this practice will persist, as on the score of economy and of metallurgical quality smaller melting units are finding a good deal of favour. These smaller units may be fired with electricity or gas or oil, while the larger units, being of the reverberatory type, usually employ solid fuel, either directly employed, or through gas producer units. A comparison of the fuel consumption given by one firm using both methods shows about 80 therms per ton for the solid fuel used in a large furnace against 33 therms per ton of town's gas in a furnace of only 10 cwt. capacity. Taking the two industries it is evident that the range of furnaces used is wide, but that, and particularly in the non-ferrous industry, small units are far more numerous than large, and since they are balanced with the units of fabricating plant in a large number of factories they are likely to be a persistent feature in the trade.

Furnace Conditions

The important matter of finish and surface quality of non-ferrous materials accounts for the attention paid within the industry to the effect of furnace atmospheres and conditions upon the metal. In the non-ferrous trades it is rather unusual for metal to be delivered in any but a reasonably bright state, though in the case of rods and sections made by extrusion the brightness is not a real necessity. The conditions for this finish demand not only a suitable atmosphere within the furnace but also a reasonably rapid rate of heating (except for certain precipitation treat-

* From a paper "Fuel Considerations in the Fabrication of Non-Ferrous Metals and Light Alloys" presented at the Conference on "Fuel and the Future."

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ments) so as to reduce to the minimum the time of exposure of the surface of the metal to the influence of hot gases. Combined with this relative rapidity of heating, accuracy of temperature control is of considerable importance in all reheating operations, the non-ferrous metals being particularly sensitive to the effect of variations in temperature and time of exposure.

Problems of Fuel Economy

In view of all these factors we may begin to see what is involved in a determination of the best way to utilise available fuel and how it is to be made to go farthest. The industry has to produce a large variety of alloys, all fairly highly priced; in a multiplicity of forms and tempers; from a considerable number of relatively small production units (*i.e.*, items of plant); to conserve the alloys during manufacture; and to work at comparatively moderate temperatures. It follows therefore that a number of factors must be taken into account in the endeavour to achieve the desired results in the most economical manner. For the question of fuel economy cannot be taken just by itself. It might well be that a reduction in actual fuel consumption in a certain process could be achieved by a complete change of heating method. But would that change be really economical? Would it reduce the total production cost of the material, or might it, by increasing labour costs, by incurring heavy capital charges (and therefore the earning of depreciation) for buildings and equipment, actually result in an increase of total cost while reducing that relatively small item for fuel that characterises the non-ferrous industries' production account? On the other hand, will a change of method of melting and reheating bring with it certain compensating savings in another direction? Will it, for instance, reduce the actual loss in melting? Will it reduce the oxidation or scaling in reheating? Will it bring down the labour cost? All these factors have to be examined.

It is not surprising that in the non-ferrous field there is a considerable diversity of practice and a variety of modes of heating, for casting, for reheating, and in the course of subsequent working. It is fairly safe to say that for a very long time these industries did all their melting in pit fires, fed with coal or coke, in such crucibles as they could command, and that the annealing or reheating was achieved in ovens or simple in-flame furnaces, using coal or much less frequently, coke. The transition from this relatively primitive practice is by no means yet complete—nor is there any particular reason why these old practices should be abandoned entirely so long as they are refined and polished. Where the production is that of a single—or nearly single—material, the pit fire shows itself to be rather more expensive in fuel than electric melting, but the latter method implies a greater capital expenditure, a continuity of production, and regularity of product, if this possible saving in the fuel cost is to be secured. So the pit fire is still with us, and is likely to stay—for many purposes. But it may be modified—for certain practices—into the tilting crucible type of furnace, which may employ as fuel either oil, creosote, pitch, coke, pulverised coal, or town's gas, the two first mentioned being the most common. In these furnaces the crucible size is usually considerably greater than with the ordinary pit fire. This presents both advantages and disadvantages, and whether one outweighs the other depends a good deal on the metal that is being melted, the sizes of ingots to be made, and the throughput of the factory. In view of this variety of practice which exists within the industry to-day, it is hardly surprising that there is quite a marked diversity in the actual amount of fuel consumed per ton of metal melted, even when it may be assumed that all the manufacturers are doing their utmost to use as little as possible.

Research Into Fuels

When searching for the practical answer to the problem of the ideal process (which means the proper combination of furnace and fuel) it seems that many considerations must be examined. Research on a fairly wide basis might well be undertaken, in the first instance by a statistical examination of the data that could be collected from existing practice. The opening out of the fuel position following the development of oil and of creosote pitch to economic success suggests this research programme may go much further, particularly if the price of other forms of heating rise. The admirable results obtained with gas heating (which is a form using less coal from the pit than electricity) suggest too a line of inquiry that might well be fruitful. When this is directed also to the ideal of utilising all the heat, by recuperation, preheating, or in other ways, the scope is great. But it must be emphasised that the problem is not purely that of the furnace designer, but one in which he must co-operate with the metallurgist so that the operating factors can be fully examined.

Concurrently, it seems desirable that the non-ferrous industries should take a leaf from the book of the steel maker and consider seriously the best way to utilise all the heat in the fuel and not waste it by letting it "go up the chimney." In the steel industry, preheating of air and gas by the use of recuperators is a regular practice. In the non-ferrous industries such practice is not so common, and is worthy of far greater attention.

Inevitably, in the non-ferrous field the mind of the producer turns to the conservation of metal in his processes. In the balance sheet metal loss may very easily be a larger item than fuel. If, for instance, it be taken that the cost of the fuel used in melting brass, of heating it for rolling, and of annealing it during cold rolling, amounts to, say, 26s. per ton *in toto*, a loss of metal in all processes greater than 2 per cent will outweigh the fuel cost. Metal losses can readily creep up and are almost invariably the by-product of heating operations, arising either from mechanical losses into the ashes, which may be recoverable but cost money in the process, or by the oxidation or volatilisation of the metals during the actual heating processes. Various factors promote this oxidation or volatilisation, and some are more potent in one process than another. In a general way, however, it may be said that the safest way to keep these losses to a minimum lies in attention to temperature, time, and atmosphere.

Carriers Promote Economy

In reheating operations there is little doubt that economy is promoted by the use of a furnace through which the material moves from the cool to the hot end, and this movement should preferably be effected automatically or mechanically. In the case of round billets or ingots the passage can be achieved by rolling through the furnace on an inclined floor, and this process certainly promotes uniformity of temperature within the metal. With slabs the progress must be achieved by a moving carrier of some kind or another, the less bulky the better. As the material is constantly passing out—at the requisite temperature—a good deal of heat may be lost at the furnace exit, by radiation or by convection, unless the doors are kept closed and fit fairly well. It is better for them to return automatically to the closed position when the billet or slab is withdrawn. Similarly, it is well to have the transit from the furnace to the press, or rolls, as short in distance as possible, and mechanised to the best advantage, so that the minimum time is occupied in transferring. It is also important to arrange that during any stoppage of the flow of metal through the furnace, the fuel supply shall be cut off—or, at any rate, suitably reduced. This affects both fuel consumption and metal losses.

In annealing, and particularly of sheets, one of the most important problems is to secure uniformity of temperature throughout the mass of metal within approximately the same heating time. This is always desirable for metallurgical reasons, but in addition usually has a bearing on the full consumption. A stack of sheets pushed into a furnace on a charger may, and generally does take a long time to heat through. This exposure is usually bad for the metal—promoting grain growth on the outer sheets through which the heat must pass, not to mention greater scaling. A long soaking for a proportion of the charge is almost inevitable with such an arrangement, and this does not promote a low fuel consumption. If the sheets must be stacked, the pile should preferably be interrupted by spacers and if this device be resorted to, there is a premium on air circulation within the furnace. This matter of circulation of the furnace atmosphere is one of general importance. A great measure of turbulence of the hot gases within the furnace is a good and useful feature, for either air or gas, if stagnant, acts as an insulator, and prevents that intimate contact between all parts of the charge with the source of heat which alone can bring about rapid, and therefore economic, heating. The alternative method of heating—not in stacks, but by passing the sheets through the furnaces on a moving carrier—obviates the soaking danger but brings other troubles with it, in particular the heat consumed and continuously lost in heating the carrier. As with reheating, so in annealing, the loss of heat through the doors may be quite appreciable and it is certainly important to arrange for rapid charging and discharging of the furnaces.

Effective Maintenance

Mention has been made of the utilisation of waste heat. This, of course, applies particularly to furnaces using liquid and gaseous fuel—whether town's gas or producer gas or oil. The recuperative principle is obviously a sound one, and, applied to such types of heating, will be definitely rewarding. One thing that stands out in most installations is the need for sound and effective maintenance. This ranges from such matters as the correct alignment and setting of oil burners at one end of the scale to the repairing of leaks in gas ducts or mains or furnace hearths at the other. In between, perhaps, comes the question of keeping flues, grates, and fire boxes clean. In the operation of furnaces—for all purposes—cleanliness is a supreme virtue. A dirty or a choked furnace can never be efficient. And here it may be interpolated that there is a vicious circle connecting fuel consumption and spoilt metal. Bad practice in the thermal operations may do great harm to the metal—either scrapping it entirely or rendering necessary a further treatment at high temperatures. In one case, both metal and fuel are lost, in the other a double (or greater) quantity of fuel is needed to achieve the requisite output. Money spent in ensuring the successful prosecution of a metallurgical operation is usually, in the long run, money saved.

U.S.A. Aluminium

Decline In Output

PRIMARY aluminium output in the United States in 1945 is estimated at 496,487 short tons, a decline of 36 per cent from the 776,446 tons produced in 1944 and 46 per cent below the record of 920,179 tons in 1943, according to the Bureau of Mines, U.S. Department of the Interior. There was a moderate production increase early in the year as a result of temporary military reverses on the western front in Europe, but output dropped steadily after May as the war drew to a close. All Government-owned aluminium metal and alumina plants were closed by October 31, 1945, leaving only the privately-owned plants of the Aluminum Company of America and Reynolds Metals Co. in operation.

Recovery of secondary aluminium in 1945 totalled 298,387 short tons, compared with 325,645 tons in 1944. It required the consumption of 323,676 tons of aluminum scrap, of which 10 per cent was old and 90 per cent was new scrap. Stocks of virgin ingot aluminium held by the Reconstruction Finance Corporation on December 31, 1945, totalled 185,750 short tons. Total stocks of primary and secondary aluminium held by producers, distributors, consumers, and the Government, plus that available from wrecked and obsolete aircraft, are estimated to have been more than 1,000,000 tons at the end of 1945. Apparent domestic consumption of primary aluminium in 1945 increased 7 per cent to 796,081 short tons (744,627 in 1944). This figure is somewhat inflated, however, inasmuch as Government stocks in the U.S. increased greatly during the year.

Record Imports

Imports of crude and semi-crude aluminium in 1945 reached a record level of 339,293 short tons, valued at $98,289,943, three times as great as the 1944 entries, according to the U.S. Department of Commerce. The tremendous increase was a result of war contracts between the U.S. and Canada. All the imports of crude metal, scrap, plates, sheets, and bars were from Canada, except for 589 tons of plates, sheets, and bars shipped from the U.K. Imports of aluminium (crude metal and alloys only) constituted 42 per cent of the apparent consumption of primary aluminium during 1945. Exports of crude and semi-crude aluminium during 1945 dropped to 6543 short tons valued at $3,064,240 from the previous year's peak of 188,521 tons valued at $73,578,734. Virtual cessation of Lend-Lease shipments of primary aluminium to Russia caused the precipitous drop in exports.

World production of primary aluminium is estimated at 916,000 metric tons in 1945 compared with 1,702,000 tons in 1944. The greatest decline in output was in Germany and the central and south-eastern European countries, where facilities were captured during the first four months of the year. Of the 1945 production, it is estimated that 49 per cent was by the U.S., 21 per cent by Canada, 9 per cent by U.S.S.R., 4 per cent each by France and the U.K., and 13 per cent by other countries.

U.K. Tin Position

Fall in Ore Stocks for September

A REDUCTION of nearly 1000 tons in the stocks of tin ore in the U.K. at the end of September is reported by the Ministry of Supply. Stocks totalled 8052 long tons, as compared with 9049 long tons at the beginning of the month.

Stocks of tin metal held by the Ministry on September 30 were 8738 tons, compared with 9267 tons at the beginning of the month, while stocks held by consumers at the end of September were calculated at 4237 tons and reported to be 3908 tons. There were no arrivals of tin metal during the month, but production is shown at 2507 tons.

Deliveries of tin to U.K. consumers during September amounted to 2766 tons and deliveries for export were 270 tons. Consumers' consumption of metal during the month was 2573 tons.

Concentrates of zinc, copper, and lead are being produced on an increasing scale by the Buchans mine in Newfoundland, according to American industrial press reports. With a daily output of 1200 tons, the mine is exceeding its 1945 production by 200 tons a day. Total production of concentrates for 1945 is recorded as: zinc, 93,567 tons; lead, 39,567 tons; copper, 17,570 tons.

Chemical Exports

Further Drop in Figures for September

THE value of U.K. exports for September was £70.8 million, a reduction of £6.5 million on the August figure, which was itself £14.5 less than the record July figure. About half the September reduction, states the Board of Trade, was due to the smaller number of working days (25 as against 26 in August). The reduction for both the past two months was essentially due to the general holiday season, which continued well into September, and present indications are that exports in October will approximately equal the peak figure of £92 million recorded for July.

The general decline in the September exports was reflected in the exports of chemicals, drugs, dyes and colours, which, according to the Board of Trade monthly accounts, were valued at £4,575,468. This is £1,251,980 less than the August figure, but £2,529,498 more than for September last year; and £3,968,799 more than the monthly average for 1938. Chemical manufactures and products (other than drugs and dyestuffs) accounted for £2,670,536 of the total; drugs, medicines and medicinal preparations for £839,100; and dyes and dyestuffs, and extracts for dyeing and tanning, for £506,583. British India again led the buyers with purchases totalling £696,005; Australia was again second with £360,271; and Denmark came into third place with £251,320. For the nine months ended September 30 the total was £48,527,138, which is £21,883,958 higher than the figure for the first nine months of last year.

The value of imports generally for September was £106.1 million, a reduction of £14.9 million compared with August. About a quarter of the reduction was due to the shorter month. Imports of chemicals, drugs, dyes and colours were valued at £981,673, which is £545,179 less than the August total; £50,640 less than for September last year; and £153,728 less than the monthly average for 1938. The U.S.A. was the largest supplier, with goods valued at £177,255; the Argentine Republic was second (£124,570); and Canada third (£81,339).

Leather Chemists

Paper on "Currying and Fatliquoring"

AT a meeting of the Northampton Group of the British Section of the International Society of Leather Trades' Chemists, at the Northampton College of Technology, on October 24, with Mr. D. Woodroffe, M.Sc., A.R.I.C., in the chair, Dr. M. P. Balfe, B.A., F.R.I.C., gave a paper entitled: "Currying and Fatliquoring."

He dealt first with the chemical changes which may occur to the grease in the leather. Triglycerides are split by the action of moulds forming free fatty acids, and unsaturated oils, such as cod oil, may form gummy spues on oxidation. Factors which can affect these two types of changes were discussed. The most important feature of currying was the effect on fibre structure. For high tensile strength and good flexibility, a low angle of fibre weave and a good degree of splitting of the fibres into fibrils were required. The angle of weave was not greatly affected by the currying processes, but was governed mainly by the type of skin and the tanning process. The main purpose of currying was to retain in the finished leather the fine splitting which was present in the original leather before drying. This was affected by the pre-tanning and tanning processes. The methods by which oil or grease was put into leather by various currying processes, such as hand stuffing, drum stuffing and fatliquoring, were described.

The ease with which oil can penetrate into the fine inter-fibrillary spaces so as to lubricate the fibrils and preserve the fine splitting was affected by the viscosity of the oil and the oil/water interfacial tension. Representative figures for these properties in a number of oils were given and used in a comparison of the effects produced by different oils. Cod oil was particularly suitable where good penetration was required, on account of its comparatively low viscosity and interfacial tension. Neatsfoot oil penetrated less well because it had higher values for these properties. Mineral oil could give satisfactory results if one with a suitable viscosity was selected and modified to give the appropriate interfacial tension. Other examples were given, and slides were shown to demonstrate the effect on fibre structure.

Birmingham's Giant Nuclear Research Machine

A gigantic machine weighing more than 1000 tons and containing a magnet 30 ft. in diameter, is being installed at Birmingham University. The machine, which will be used for nuclear research, will develop energies amounting to 1,000,000,000 volts. According to Professor M. L. Oliphant, who gave details of the machine, the enormous electrical energies which it will attain may help to solve the problem of the nature of the "glue" which holds the atomic nucleus together. The machine, Professor Oliphant emphasised, is not a large cyclotron.

"Portraits of an Industry"

I.C.I. Exhibition of Pictures

FEW people, whether inside the chemical industry or outside it, can fail to have admired the series of striking I.C.I. advertisements in the lay Press, portraying typical chemical workers and telling, in simple, every-day language, something of their jobs. Apart from the fact that the portraits themselves made an instant appeal and that the text conveyed interesting information not generally known, the general lay-out of the advertisements evoked high praise.

An opportunity to see the original portraits, which were executed by well-known artists in oils, water-colours or other media, is now presented to the general public by the Central Institute of Art and Design, under whose auspices an exhibition of the pictures is being held in the Suffolk Galleries, Suffolk Street, London, W.C.2 (close to the National Gallery), by courtesy of the New English Art Club. The exhibition, which has the title of "Portraits of an Industry," and is described as "An exhibition of pictures depicting the personnel, aspects and services of the British Chemical Industry," is open daily from 10 a.m. to 5 p.m. (except Sundays), until November 9.

The first of its kind to be held in this country, the exhibition embraces 85 pictures by nineteen artists. It demonstrates the possibilities of industry becoming an intelligent patron of the fine arts and, at the same time, contributing towards a higher standard of publicity. The application of art to advertisement by I.C.I. ranks high among the many notable developments in the relation of the arts to the public that have taken place during recent years. Indeed, the policy followed by I.C.I. of thus employing distinguished artists is of no little significance. It indicates that advertisement, so prosecuted, can not only provide artists with a remunerative source of employment, but afford the public a new and beneficial contact with the arts.

The origin of this movement is to be found in the fight which, at the outbreak of war, British scientists had to make against the tremendous world prestige enjoyed by Germany. That prestige was the outcome of years of forceful propaganda in a field where Great Britain had done virtually nothing in that direction. As the war progressed, the falling off of Great Britain's international trade progressively weakened the contacts between her and the world beyond this island, and in this way British goodwill was still further jeopardised. As the export of goods declined, so it became all the more

Samuel Wilson is engaged in dyestuff manufacture at the I.C.I. factory at Huddersfield.

Alice Wright filters and inspects liquid synthetic resin.

John Williams is manager of a heavy chemical works at Runcorn.

necessary for ideas to be projected in their place

These were the considerations which, in 1941, impelled the I C I public relations controller, Mr Sidney Rogerson, to seek his directors' permission to launch a public relations programme designed to raise throughout the world the prestige of British research and the British chemical industry The permission was forthcoming To achieve his objectives, Mr Rogerson came to the conclusion that he should break away from the conventional form of advertising, that he should be original, not only in manner, but in idea; and that all attempts at "ex parte" pleading should be shunned

The form of advertising developed as a result of this was designed to tell the public something that was interesting and yet not commonly known It also had regard to Mr Rogerson's further contention that advertising, instead of being an unlovely source of revenue to newspapers, could and should be an adornment to the pages in which it appeared It was not enough, he felt, nor even sound, to take space in which to place a blatant, staring advertisement on the assumption that the reader could be bludgeoned into accepting the message

As Sir Charles Tennyson states in a foreword to the exhibition catalogue "It is not too much to say that these I C I advertisements have made advertising history They have carried a message overseas not only on behalf of the British chemical industry but of British art Their influence has been deep and will, I am sure, be lasting"

Henry Bowmer works at the plastics factory, Welwyn Garden City.

Sir Charles goes on to say: "As chairman of the Central Institute of Art and Design, I cordially welcome this policy of a great industrial organisation It is educating the public It is showing both the Press and other advertisers that work of dignity, beauty and character can be more effective than the blatant and flashy It offers leading artists a worthy outlet for their talents"

Chemicals in Holland

Development of a Plastics Industry

AMONG the many chemical projects in Holland which are aiming at the home production of vital articles formerly imported from Germany, the plans for manufacturing plastics seem likely to materialise soon. For some six months the matter has been under serious consideration between the Government authorities at The Hague and the industries concerned; but the problem of supplying the primary chemical products, except for casein and phenol, has so far proved insoluble. Holland is in need of plastic materials for making export products, such as lacquers, but its cellulose industry is still too small. Two moves are being made, however. Under the title of International Synthetic Materials Industry, Ltd. (N.V. Internationale Kunststoffen Industrie), the Internationale Kunsthoorn Industrie of Voorschoten is to start a company for the production of thermoplastic and thermosetting articles; while the rubber-tyre producer, Vredestein Ltd., of Loosduinen, known to be in close relation with the American firm of Goodrich, is putting up another plastics factory at Deventer, under the name of N.V. Kunstoffenfabriek Plastico.

Nitrogen Products

The output of nitrogen by the State Mines concern at the Lutterade factory in the current year is estimated at 54,000 metric tons; and steps are being taken to produce also calcium nitrate, ammonium nitrate, and phosphate. Meanwhile, Dutch output of superphosphate is said to be very near the normal and bids fair to compete in the foreign market, as there is sufficient supply of imported pyrites and raw phosphates. As a matter of fact, superphosphate and sulphuric acid represent the most valuable items among all the chemical products of Holland, being valued at some 28 million florins.

The Royal Dutch oil refinery at Pernis, which during the war endured heavy allied air attacks, not to mention the wholesale looting of its machinery by the Germans, is now wholly restored, according to a statement made by the subsidiary company, Bataafsche Petroleum Maatschappij, which hints at impending new installations. For the time being the throughput (in metric tons) for crude oil amounts to 45,000 a month, cracking 60,000, polymerisation 3000, the same for hydrogenation and special petrol distillation, asphalt distillation over 20,000, gas processing 10,000, redistillation 30,000, lubricants 2000, and refining 15,000 tons. At the same time crude petroleum—so far of inferior quality—is being produced by the Bataafsche company in the province of Drenthe, near the German frontier. The well is believed to extend beyond the frontier and the Dutch are claiming it along with other frontier adjustments. At Schoonebeek 23 derricks have been erected, and the present crude output is at the rate of 300,000 metric tons per annum, with methane and carbon black as special derivatives.

Output of salt in Holland, for which the Royal Dutch Salt Industry, Ltd., of Boekelo and Hengelo, has the monopoly, at the moment amounts to at least 170,000 tons per annum, compared with 54,000 tons in 1945 and the record output of 209,000 tons in 1940. Because of urgent demands for edible salt as well as for chemical products, an ambitious plan aims at increasing the yearly output to 800,000 tons. The company is well equipped with machinery and capital and is producing also chlorine, sodium lye, hydrochloric acid, caustic soda, etc. The fact that the German salt industry is no longer able to compete on the Dutch market is stimulating these plans.

Among insecticides, DDT is already being produced in Holland, while Gammexane is to be manufactured in due course. A new anti-itch preparation called Debraline, the composition of which has not yet been revealed, has been released for the home and export market.

Anglo-Dutch Discussion

Business Men Meet

REPRESENTATIVES of Dutch and British industries met recently in London at the invitation of the Federation of British Industries, to discuss matters of common interest. Sir Clive Baillieu, President of the F.B.I., presided at the first session, while the Dutch delegation was led by Mr. H. P. Gelderman, President of the Netherlands Federation of Industries. Discussions between the delegations ranged over a wide field, from government control over business life to the proposals of the Allied Control Commission on the level of German industry.

On the question of International Boards which have been created, or are to be created, to distribute raw materials, the Dutch delegates thought that smaller countries should have more direct and effective consultation with the Boards. The American proposals for an international conference on trade and employment were welcomed by both delegations. On the matter of the post-war level of German industry, the Dutch delegates pointed out the close connection between Dutch prosperity and restoration of German industry, and referred to their pressing need for German goods, especially machine spare parts. At the end of the conference the two sides decided to exchange views periodically.

A CHEMIST'S BOOKSHELF

THE CHEMISTRY OF THE ACETYLENIC COMPOUNDS; Volume 1—The Acetylenic Alcohols. By A. W. Johnson, Ph.D. London: Edward Arnold. Pp. 370. Price 35s.

Reference even to modern textbooks of Organic Chemistry will show that compared with other hydrocarbons very little space is devoted to acetylene or the alkynes in general and the same is unfortunately true of any other compounds which contain the characteristic acetylenic triple bond. This means that the average organic chemist, during his training, is not made aware of the many compounds containing a triple bond, which, far from being academic curiosities, are of great commercial importance. The situation with regard to acetylene itself and related hydrocarbons has been reviewed up to 1938 in several textbooks published in America during the period 1934-45.

The present volume is the first of a series of three which aims at filling the gap with regard to other functional derivatives of acetylenic compounds and deals with the acetylenic alcohols. Volume II and III will review the acids and the carbonyl compounds respectively. Volume I is divided into three parts, the first of which deals with the monohydric acetylenic alcohols, part 2 with the acetylenic glycols, including polyhydroxy acetylenic compounds, and part 3 with the polyacetylenic compounds. The same method of presentation is followed in all three parts and this has the advantage of facilitating reference to any particular branch of the subject. The general layout of each section is that there is an historical introduction giving details of the discovery of the first member of the series under review. After a note regarding the nomenclature of the compounds all the known methods of formation are listed and these are divided up into general methods of preparation and miscellaneous special methods. In a great many cases the remarks under the methods of preparation are directed mainly at pointing out the type of compounds to which the method is applicable. For actual details of the preparation the reader is referred to the original literature for which copious references are given, and these are collected together at the end of each section.

The properties of the compounds are divided into physical and chemical. Under the former heading are listed such things as dielectric constants, Raman and absorption spectra and for several such properties there is no discussion but merely a list of original references. Since all the types of molecules under review contain at least two functional groups, i.e., the triple bond and the hydroxyl group, consideration of their chemical properties is divided into two sections—those in which the hydroxyl group is concerned and those involving the acetylenic bond.

Owing to wartime conditions there has been a delay between completion of the text and publication of the book. In order to overcome this drawback the author has added an appendix, in which he has reviewed all the papers and patents which have been published during the hiatus. By this means all the literature is reviewed up to September, 1945. There are also separate appendices dealing with the chemistry of the rubenes and applications of acetylenic compounds to syntheses in the sex hormone series.

In this volume the author has endeavoured to review the extensive literature of the acetylenic alcohols and in all cases many references are quoted. In addition he has summarised in tabular form at the end of the book the physical constants of all the known acetylenic alcohols listed according to the system of Richter's Lexikon. Much trouble has been taken in compiling the wealth of data in the present volume and it will prove of great value to research workers who wish to use these reactive acetylenic compounds as starting materials in organic syntheses, a branch of chemistry which is as yet little developed. It is to be hoped that the other two volumes will not be long delayed.

Alumina Preparation

U.S. Research

A REPORT of the Bureau of Mines, United States Department of the Interior, deals with pilot plant investigations concerning preparation of alumina from potassium alum. Four different procedures for dehydration of alum were investigated, spray drying, rotary-kiln drying, dry grinding in a thermal ball mill, and dehydration in the vertical-column flash dehydrator. Based upon fuel requirements and other practical considerations, the vertical-column dehydrator, or some other modification of its operating principle, offers the best possibility for commercial use.

Thermal decomposition of dehydrated alum was investigated in both a hearth furnace and a direct-fired rotary kiln. The rotary kiln appeared to have several marked advantages, chief among which is the lessened possibility of contamination of the finished product.

In the report of the annual dinner of the A.B.C.M. in our issue of October 19, Mr. Ian Orr, chairman of the British Barytes Producers' Association, was, by mistake, referred to as Sir Ian Orr.

German Technical Reports

Latest Publications

SOME of the latest technical reports from the Intelligence Committees in Germany are detailed below. Copies are obtainable from H.M. Stationery Office at the prices stated.

BIOS 479. Some aspects of the German peat industry (2s.).

BIOS 609. Non-destructive testing of materials (2s.).

BIOS 662. *I.G. Farben, Ludwigshafen*: Manufacture of phenylbetanaphthylamine, antioxidant for rubber (6d.).

BIOS 663. *I.G. Farben., Ludwigshafen*: Manufacture of synthetic resins (6d.).

BIOS 665. *C. F. Boehringer and Sohn, Sandhoferstr., Mannheim-Waldhof*: Manufacture of vanillin, coumarin, anisaldehyde (6d.).

BIOS 666. *I.G. Farben, Uerdingen*: Manufacture of phthalic anhydride, benzoic acid, etc. (1s.).

BIOS 667. *I.G. Farben., Mainkur*: Miscellaneous chemicals (insecticides, textile agents, oils) (1s.).

BIOS 678. *I.G. Farben, Wolfen*: Manufacture of cement and sulphuric acid from anhydrite (3s. 6d.).

BIOS 709. *I.G. Farben., Hoechst-am-Main*: The production of tetranitromethane and nitroform—alternative compound to nitric acid for use as an oxygen donator in the V. weapons (1s. 6d.).

BIOS 710. *Kalle and Co. (I.G. Farben A.G.), Wiesbaden, Biebrich*: Manfacture of biolase (starch-hydrolysing enzyme) (1s.).

BIOS 716. German steel foundries (includes information on silicosis preventive measures) (6s. 6d.).

BIOS 719. *Interview with Professor Otto Bayer, formerly director and head of the scientific laboratories of I.G. Farben., Leverkusen*: Chemistry of isocyanates and the new polyisocyanates (1s.).

BIOS 740. *G. F. Boehringer und Soehne, Mannheim-Waldhof*: Commercial organic solvent production (1s.).

BIOS 741. *Zellstofffabrik A.G., Mannheim*: Recovery and dehydration of alcohol from spruce-wood waste sulphite liquor (1s.).

BIOS 743. *I.G. Ludwigshafen*: Manufacture of cyclohexanol, cyclohexanone, cycloketone resins (1s. 6d.).

BIOS 748. *I.G. Ludwigshafen-Oppau*: Manufacture of fatty acids by oxidation of paraffins, hydrogenation of the fatty acids (2s.).

BIOS 749. *I.G. Hoechst*: Manufacture of diketene from acetic acid (6d.).

BIOS 750. *I.G. Ludwigshafen*: Manufacture of monomeric styrene.

BIOS 753. *I.G. Ludwigshafen*: Manufacture of phthalic anhydride and phthalates (2s.).

BIOS 754. *I.G. Oppau and Ludwigshafen*: Hydrochloric acid (1s.).

BIOS 757. *I.G. Ludwigshafen*: Manufacture of ethylene cyanhydrin (6d.).

BIOS 759. *I.G. Oppau*: Pilot plant for manufacture of acrylonitrile (6d.).

FIAT 66. Glossary of some German names for chemical products used in the paint, varnish and lacquer industry (1s. 6d.).

FIAT 92. German processing of fats, oils and oilseeds (10s. 6d.).

FIAT 292. Manufacture of laboratory apparatus, instruments and equipment (1s. 6d.).

FIAT 556. Some aspects of rayon and synthetic fabric dyeing and processing (5s.).

FIAT 686. Casting methods for aluminium and aluminium alloy billets (1s. 6d.).

FIAT 713. *Schering A.G., Berlin*: Cellulose acetate manufacture (1s. 6d.).

FIAT 499. Production of wood sugar and its conversion to yeast and alcohol (11s.)

Butane in Scotland

Distribution on Larger Scale

SCOTTISH Rural Gas, Ltd., is developing the distribution of butane throughout Scotland on an increasing scale, consequent on improved conditions and the Government approval of the re-establishment of country workers in better homes.

Authority has been given for the erection at Perth of a large storage building for the butane cylinders, while transport has now been organised to bring the cylinders from England direct to the depot at Perth and elsewhere. There is also a strong possibility that a manufacturing source will be established in Scotland in the early part of 1947 to manufacture the gas, thus facilitating the development of a Scottish butane industry. No precise details are available of this development as yet. The company has opened offices at Aberdeen, Inverness, and in Edinburgh and Glasgow, while the Western Highlands are due for early development.

A main problem at present is the shortage of equipment, since the gas service is limited to the extent to which equipment is available. A recent important development is the design of a two-way automatic cylinwhich transfers flow from a depleted cylinder to the remaining full cylinder without depressing the flame. This new control is being manufactured in Scotland and is exclusive to the company. As a matter of policy, only ex-Service men are being employed in this development programme.

Parliamentary Topics

Fluorine Hazard

IN the House of Commons, last week, Mr. Herbert Morrison, replying to a question by Mr. Charles Williams, stated that investigation of the fluorine hazard near Fort William had involved extensive collection of information and analysis of materials. The work had only just been completed and he was not yet in a position to say when a report would be published. He would give consideration to the suggestion that the report should be made public.

Soap Substitutes

Mr. Collins asked the Minister of Food whether he would make a statement with regard to the progress made in the manufacture of soap substitutes.

Mr. Strachey replied that additional plant to produce raw material for the manufacture of soap substitutes was going up, but until it comes into operation about next March, shortage of suitable raw material would remain a limiting factor.

Ground Nuts

Sir P. Macdonald asked the Secretary of State for the Colonies whether he would arrange for the early publication of the report of the Commission of Inquiry which went to East Africa to investigate the possibilities of large-scale production of ground nuts in Tanganyika and Northern Rhodesia.

Mr. Creech Jones said the Government was actively considering the action to be taken on the report of the mission and he hoped a statement would be made at an early date. The Government would bear in mind the desirability of publishing the material made available.

Production of Penicillin

The Ministry of Supply, replying to a question by Wing-Commander Robinson, said the present rate of production of penicillin in Great Britain was about 260,000 mega-units a month. During September, export licences were issued for about 149,000 mega-units.

Russia and German Industry

Scientists Deported

RESEARCH scientists and specialist engineers are among the German technicians and skilled workers whose recent removal to Russia from the Russian zone of Germany and the Russian sector of Berlin has provoked international interest and controversy. Reports of the dismantling or projected dismantling by the Russians of German manufacturing plant and its transfer to Russia as reparations has also aroused speculation and concern.

Of 300 technical specialists and skilled workers removed with their families last week from Jena in Thuringia, 280 were employed at the famous glassworks of Carl Zeiss and 20 at the Schott glassworks and associated factories. Dismantling may not yet have started at these undertakings, but it is understood that a Russian commission has been supervising an inventory of all plant.

Among other undertakings from which personnel are reported to have been removed are the firm of Hentschel at Stassfurt in Saxony, where aircraft was manufactured during the war; the Koetschen textile factory at Apolda, and heavy industrial undertakings in the Chemitz area; the Leuna Plastics Works at Merseburg; the Siebel aircraft plant at Halle; the Bleichart machinery works at Leipzig; and the Rabe Institute at Bleicherode in Saxony, where V2 parts were made.

Dismantling of the latter works and of another similar undertaking at Lehesten in Thuringia is reported to have begun, while other plants said to be scheduled for dismantling are those of the various branches of the Zeiss undertaking. The Zeiss-Ikon works at Dresden are stated already to have been dismantled and transferred to Russia.

Protests have been made by representatives of the Schott works, at which 2750 people are employed in the manufacture of raw optical, technical, and chemical glass, and of the Carl Zeiss firm, formerly the world's greatest optical works, who employ 14,000. If these two great firms, upon which the town of Jena depends, should close, thousands of glass blowers who work at home in the Thuringian forest making chemical glassware and glass ornaments will be deprived of raw material. Furthermore, since the two firms formerly exported a quarter of their total output, the effects would be more than local, and industry and research in other countries would be deprived of essential equipment.

According to *The Times'* correspondent few, if any, of the personnel who have gone to Russia went voluntarily.

Representations made to Russia by the other occupying authorities in Germany have drawn a reply from the Russians, who defend their actions on two counts: firstly, that all the German workers went voluntarily and under contract freely accepted; secondly, that the British, American, and French have themselves carried out similar deportations on an even bigger scale.

UNRRA supplied, from the beginning of its operations until the end of July, 1946, a total of 1,471,020 tons of oil products to various European countries.

Personal Notes

MR. N. NEW, B.Sc., has been appointed Assistant in Chemistry at University College, St. Andrews.

MR. W. RHYS-DAVIES, F.R.I.C., inventor of waterproofing, dyeing and finishing processes, and formerly consulting analytical chemist in the West Riding of Yorkshire, has been elected to Fellowship of the Textile Institute.

SIR JOHN ANDERSON, PROFESSOR ERNEST LAWRENCE, professor of physics at the University of California; and PROFESSOR NIELS BOHR, director of Theoretical Physics at the University of Copenhagen, received honorary degrees of Doctor of Science at McGill University.

DR. ADAM S. T. THOMSON, who played an important part in research and the design and development of new rocket weapons during the war, is to succeed Professor W. Keir as Professor of Civil and Mechanical Engineering and Applied Mechanics at the Royal Technical College, Glasgow, where he was formerly a student, and is now senior lecturer in the department mentioned.

Obituary

MR. WILLIE WOOD, a local director of Thos W. Ward, Ltd., Sheffield, died suddenly on October 21, aged 62. Brother of Mr. George Wood, joint managing director of the firm, he joined the staff in 1897 and had been in control of non-ferrous metals departments since 1922.

MR. G. HART, who had been connected with the Skinningrove Iron Co., Ltd., for 30 years, and of recent years was steel plant manager, has died aged 62. At the funeral the company was represented by the chairman and managing director, Mr. R. Mather; the general works manager, Mr. H. D. W. Debenham; and, among others, the chief chemist, Mr. E. G. Brown.

Royal Institute of Chemistry

New Fellows and Associates

THE Council of the Royal Institute of Chemistry of Great Britain and Ireland announce that the following have passed the examinations for fellowship: Kenneth Saddington, B.Sc. (Lond.) (inorganic chemistry); E. F. Norris, B.Sc. (Lond.), A.M.I.Chem.E. (organic chemistry); R. J. Salmon, M.Sc. (Manc.) (biochemistry) L. C. Dutton (biochemistry, with special reference to nutrition and vitamins); A. J. M. Bailey Malcolm, B.Sc. (Lond.); Raymond Ganday, B.Sc. (Lond.); J. McLaren Malcolm, and Joseph Markland, B.Sc. (Lond.) (the chemistry, including microscopy, of food and drugs, and of water); F. S. Archer (industrial chemistry with special reference to petroleum); D. G. Wallwork (industrial chemistry with special reference to the manufacture of pulp and paper); W. K. Matthews (general analytical chemistry).

The following passed the examination in general chemistry for the associateship of the Royal Institute of Chemistry: P. L. Barrett, Central Technical College, Birmingham; T. J. Bowditch, Technical College, Cardiff; J. S. Broadley, The University and The Royal Technical College, Glasgow; W. D. Carswell, B.Sc. (St. Andrews), The University of St. Andrews; A. V. Clark, South-West Essex Technical College, Walthamstow; W. E. Clark, Central Technical College, Birmingham; C. D. Cook, City Technical College, Liverpool; C. L. Denton, Central Technical College, Birmingham; C. V. Green, The University, Liverpool; J. Ruff Gwilt, Acton Technical College, London; Francis Hardesty, Rutherford College of Technology, Newcastle-upon-Tyne; Clive Jackson, Harris Institute, Preston; H. T. Jobsan, Rutherford College of Technology, Newcastle-upon-Tyne; C. R. Lloyd Jones, B.A. (Cantab.), The University, Cambridge; K. G. Latham, B.Sc. (Lond.), South-West Essex Technical College, Walthamstow; I. A. McChristie, Royal Technical College, Glasgow; G. W. Nendick, Municipal Technical College, Hull; K. R. Payne, University College and College of Technology, Leicester; Donald Pickles, B.Sc. (Lond.), Municipal Technical College, Halifax; Bernard Priest, Technical College, Coventry; S. G. Reeve, Woolwich Polytechnic, London; D. A. Reilly, B.Sc. (Manc.), The University, Manchester; A. D. Richmond, Technical College, Blackburn; Edward Rogers, Technical College, Huddersfield; J. R. H. Schenkel, Central Technical College, Birmingham; F. T. Smith, Woolwich Polytechnic, London; W. D. Smith, College of Technology, Manchester; G. F. Snook, B.Sc. (Lond.), University College, Southampton; R. K. Taylor, City Technical College, Liverpool; Miss Mary Warner, B.Sc (Lond.), Municipal Technical College, Hull; J. A. White, Birkbeck College, London; L. H. Williams, College of Technology, Manchester; J. B. S. Wilson, South-West Essex Technical College, Walthamstow.

A new factory is to be built by MacLachlan Clark & Co., Ltd., manufacturing chemists, Glasgow, in the Hillington Industrial Estate, Glasgow, for the manufacture of a wide range of specialities. Modern in every way, the factory will cover about 20,000 sq. ft. and will be ready for use in about six months. It will be used essentially to develop export business.

General News—From Week to Week

Copies of D.T.D. Specification 693, "Aluminium Alloy Tubes," are obtainable from H. M. Stationery Office, price 1s.

Registered and unregistered letters, also printed and commercial papers, may be sent by surface route to all countries in Europe, except Germany.

The "Britain Can Make It" exhibition at the Victoria and Albert Museum, London, is to remain open until December 31. It will then be dismantled.

The address of the Hygienic Chemical Co., Ltd., has been changed to 600 Commercial Road, London, E.14 (Tel., Stepney Green 3434; telegrams, Hygicide, Pop, London).

According to the Chemical Worker, the membership of the Association of Chemical Employers comprises 267 firms, as follows: heavy chemicals, 141; fertilisers, 33; glue-gelatine, 21; plastics, 12; drugs and fine chemicals, 60.

New colours for women's wear for the spring and summer season next year have been grouped together by the Dyers' and Finishers' Association and the British Colour Council under the heading "Summer Landscape."

With the title *You Amaze Me, Young Man*, an attractive and unusual booklet on thermal insulation has been prepared specially for managements by the Ministry of Fuel. Copies are obtainable from regional offices of the Ministry.

Mr. Shinwell, Minister of Fuel and Power, told a Dudley, Worcestershire, audience that the Government would spend £15,000,000 in the next five years to get the mining industry on its feet. Electricity would be dealt with next, and the gas industry afterwards. He would then be able to co-ordinate all forms of fuel and power in this country.

Benn Brothers, Ltd., proprietors of THE CHEMICAL AGE, will be exhibiting their trade and technical journals and other publications on Stand D.D. at the technical exhibition which will be held in the Kelvin Hall, Glasgow, from November 15-27 (10 a.m.-8 p.m.). Readers are cordially invited to visit the stand and make full use of the services available there.

At a joint meeting of the Industrial Accident Prevention Groups of Glasgow and Lanarkshire at Glasgow, last week, a talk was given by Mr. H. R. Payne, of I.C.I., Ltd. He said there was frequently resistance at first to the ideas put forward by a safety officer, but it was his business to overcome such opposition and to secure the co-operation and personal interest of the firm's higher executives and supervisors.

A series of six "Secrets of Science" films, sponsored by I.C.I., Ltd., is now in production by G.B. Instructional Ltd. Another film, showing the development of the iron and steel industry, is being produced for the Iron and Steel Federation.

It is announced by De La Rue Plastics, Ltd., that Scottish Plastics, Ltd., is transferring all manufacture of plastic mouldings to Walthamstow, Essex, as from this week-end. The Strathendry works of Scottish Plastics, Ltd., are being taken over by De La Rue Stationers, Ltd., to concentrate entirely on the production of fountain pens, pencils, etc.

A British Purchasing Agency has been set up at Minden under the Sundry Materials Branch of the Board of Trade with the purpose of centralising all exports from Germany to the U.K., except timber and scrap metal. This organisation will maintain the closest liaison with the Control Commission. All purchases are on Government account and distribution will be made through the Sundry Materials Branch of the Board of Trade. All inquiries, which should be in writing and should relate to specific goods, should be addressed to Sundry Materials Branch, 10 Old Jewry, London, E.C.2.

It is over two years since the Scottish Engineering Students' Association was formed as an all-embracing organisation in which young engineers of all branches might meet to read and discuss papers and to exchange views and ideas. That the project has been well worth while is evident from the publication of the Association's "Transactions" in the 1945-46 session, which is just to hand in the form of a well-produced, excellently illustrated little booklet. Besides providing a review of the Association's activities, it reproduces interesting papers which, but for this valuable co-ordination of effort, would have had a much more limited audience.

Foreign News

Switzerland is again importing large quantities of aluminium; imports from Canada amounted to 655 tons in July and jumped to 1622 tons in August.

It is reported that the United States Export-Import Bank has given Turkey a credit of $25,000,000, repayable in five years at 3½ per cent. to enable her to modernise her railways and industries.

A trade treaty between Brazil and Czechoslovakia was signed at Rio de Janeiro on October 17. Czechoslovakia received a credit for £5,000,000 for the purchase of Brazilian products, covering a period of two years.

Limited commercial distribution of streptomycin through hospitals began last month in the U.S.A. The plan is similar to that used initially for penicillin distribution. More than 1,600 general hospitals have been selected as depots.

Carnauba wax exports from Brazil in the first quarter of 1946, compared with the corresponding period in 1945, increased 59 per cent. in quantity (2177 to 3468 metric tons) and 130 per cent. in value (£577,870 to £1,330,600).

Among five new professorships which are likely to be estabished at the Royal Technical College, Stockholm, are new chairs in chemical plant technology and in metallurgy, according to a report in the Swedish technical press:

The Krupps armament factories at Essen are to be completely dissolved and the iron works blown up, according to a British member of the Krupps Works Control. New industries will be established on the site of the iron works.

A new plant for the production of sulphuric acid will be erected at Hamilton, Ontario, by Canadian Industries, Ltd., at an approximate cost of $1,000,000. The plant will be one of the most modern of its kind and will incorporate the latest developments in sulphuric acid manufacture.

Penicillin tooth powder has been tried out on a number of American school-boys. It was found that when penicillin was used daily in the tooth powder the oral bacterial count dropped from an average of 72,000 to 300 in three weeks, but rose again on discontinuance of the tooth powder.

Educational lectures dealing with important and timely metallurgical subjects will be included in the technical programme of the American Society for Metals during the National Metal Congress and Exposition at Atlantic City, New Jersey, from November 18-22.

Moscow radio has announced that a synthetic oil industry is being developed in the Soviet Union. It is estimated that plants under construction will yield yearly hundreds of thousands of tons of fuel by the end of the five-year plan. Some plants are under construction in Estonia.

Following an agreement reached between British, United States and UNRRA representatives on one hand, and the Italian Ministry of Industry, the Comitato Italiano Petroli (C.I.P.) and the Azienda Generale Italiana del Petroli (A.G.I.P.) on the other, the Italian refining industry will shortly resume the treatment of crude oil. Furthermore, the A.G.I.P. shall, according to the agreement, restore to their owners the assets confiscated during the war from British and American oil companies.

Plans for the establishment of a zinc refinery in Quebec are strongly favoured by the Government and will soon be realised by Canadian mining men and representatives of zinc refining interests in the United States. A considerable amount of power will be used, to make electrolytic zinc.

The first oil deposits to be discovered in Denmark are situated in the island of Mors, Limfjord, states the *Petroleum Press Service*. Tests are being made to establish whether the occurrence is sufficiently important to make drilling operations remunerative.

According to a survey recently undertaken by the reconstruction department of the Kiangsi Provincial Government, tungsten deposits in the province amount to about 1,800,000 tons, while iron-ore and lead occurrences have been estimated at 1,500,000 and 200,000 tons respectively.

A plant for large-scale production of monosodium glutamate from proteins derived from maize-cob processing is being constructed at Decatur, Illinois. When it comes into operation in 18 months it will have a yearly output of more than 1,000,000 lb. of monosodium glutamate and other amino acid products.

France's pig-iron industry worked to 65 per cent. of capacity in August, in which month output amounted to 328,000 tons, compared with 303,000 tons in July and 269,000 tons in June. The corresponding figures for steel read (in tons) 386,000, 378,000 and 345,000, respectively. Output of basic metals decreased slightly from the July level.

Stated to be the most modern of its kind in the world, a large iron and steel works at Volta Redonda, between Rio de Janiero and Sao Paulo, Brazil, was inaugurated recently by President Dutra. Construction was begun early in the war, under American technical supervision, and almost half the cost was met by a U.S. loan of £11,000,000. It is hoped that eventually the plant will supply Brazil with all the iron and steel she requires.

Forthcoming Events

November 4. Oil and Colour Chemists' Association (Hull Section) Royal Station Hotel, Hull, 6.30 p.m. Professor T. P. Hilditch: "Mechanism of Oxidation and Reduction of the Unsaturated Groups in Drying Oils."

November 4. Society of Chemical Industry (London Section; joint meeting with the Institute of Fuel). Institution of Electrical Engineers, Savoy Place, London, W.C.2, 6 p.m. Dr. C. C. Hall:: "The Operation and Development of the Fischer-Tropsch and Related Processes in Germany."

November 5. Hull Chemical and Engineering Society. The Church Institute, Albion Street, Hull, 7.30 p.m. Dr. A. N. Mosses: "Fireworks in War."

November 5. Institution of Chemical Engineers. Geological Society's Rooms, Burlington House, London, W.1, 5.30 p.m. Mr. W. F. Carey: "The Effect of Using Hot Air in Grinding Systems."

November 6. North-Western Fuel Luncheon Club. Engineers' Club, Albert Square, Manchester, 12.30 p.m. Mr. R. W. Foot: "The British Coal Industry."

November 7. Textile Institute (Blackburn Branch). Chamber of Commerce, Blackburn, 7.15 p.m. Mr. F. R. Barratt: "New Finishes."

November 7. Textile Institute (Belfast Branch). College of Technology, Belfast, 7.30 p.m. Mr. D. D. Flood: "Uses of Starch in Textiles."

November 7. Royal Institution. 21 Albemarle Street, London, W.1, 5.15 p.m. Professor J. R. Partington: "History of Alchemy and Early Chemistry.—II."

November 7. Society of Dyers and Colourists (Midlands section—jointly with S.C.I.). College of Art and Technology, Leicester, 7 p.m. Professor J. B. Speakman: "The Promotion and Prevention of Milling Shortage."

November 7. Chemical Society. Burlington House, Piccadilly, London, W.1, 7.30 p.m. Discussion on "Nitration" arranged by Dr. G. M. Bennett. Contributions to the discussion will be made by Dr. Bennett and Mr. J. C. D. Brand, Professor C. K. Ingold and Mr. D. J. Millen, Professor Gwyn Williams, and Professor E. D. Hughes.

November 7. Mineralogical Society. Geological Society's rooms, Burlington House, Piccadilly, London, W.1. Dr. Kathleen Lonsdale: "Extinction in crystals in X-ray crystallography"; Mr. C. E. N. Bromehead: "Flavus or blavus;" Professor M. A. Peacock and Dr. L. G. Berry: "Studies of mineral sulpho-salts: XIII—Polybasite and pearceite;" Dr. W. Campbell Smith and Dr. G. F. Claringbull: "Pyrophanite from the Benallt mine, Rhiw, Carnavonshire;" Dr. A. F. Hallimond and Mr. E. W. Taylor: 'An improved polarising microscope: II—The all-purposes stand."

November 7-November 27. British Plastics Federation. Dorland Hall, Lower Regent Street, London, S.W.1, 10 a.m.—7 p.m. daily. Plastics exhibition.

November 8. Oil and Colour Chemists' Association (Manchester Section). Engineers' Club, Albert Square, Manchester, 6.30 p.m. Discussion on testing methods for pigments, media and paints.

November 8. Society of Leather Trades' Chemists. (London and Home Counties Group). Leathersellers' Technical College, 176 Tower Bridge Road, London, S.E.1, 2.15 p.m. Dr. E. C. Snow: "Prospects for Leather."

November 8. Chemical Society. Joint meeting with Sheffield University Chemical Society. Chemistry Lecture Theatre, Sheffield University, 5.30 p.m. Dr. H. W. Thompson: "Some Applications of Infra-Red Measurements."

November 8. Royal Statistical Society (Industrial Applications Section, London Group). E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2, 6.30 p.m. Mr. K. A. Brownlee, Dr. B. P. Dudding, Mr. D. J. Desmond: "Some applications of multiple correlation."

November 11. Institution of the Rubber Industry (Preston section). Victoria and Station Hotel, Preston, 7 p.m. Mr. Fordyce Jones: "Story of Vulcanisation Accelerators."

November 11. Society of Instrument Technology. College of Technology, Manchester, 7.15 p.m. Mr. A. Jacob: "Handling material in bulk by weight."

November 12. Institution of the Rubber Industry (Midland Section). Goodyear Tyre and Rubber Co., Ltd., Wolverhampton, 7.15 p.m. Mr. F. Siddall: "Rubber machinery developments."

November 12. Institution of the Rubber Industry (Scottish Section). Institution of Engineers and Shipbuilders, Elmbank Crescent, Glasgow, 7 p.m. Mr. G. C. Tullock: "Training within industry."

November 13. Oil and Colour Chemists' Association (London Section). Royal Society of Tropical Medicine and Hygiene, 26, Portland Place, London, W.1, 6.30 p.m. Mr. N. A. Bennett, Mr. R. M. W. W. Wilson, Dr. F. Wormwell: "Anti-corrosive figments."

Company News

Scientific Inks, Ltd. (406,197), 65, Coleman Street, E.C.2, has increased its nominal capital beyond the registered capital of £5000 by the addition of £45,000 in £1 ordinary shares.

The nominal capital of **Carbidall, Ltd.**, manufacturers of tungsten carbide, etc., Sawrey Street, Feniscowles, Blackburn, has been increased beyond the registered capital of £3000 by the addition of £3000 in 10s. ordinary shares.

The report of **Lightalloys, Ltd.**, for the year ended June 30 shows net trading profit of £19,072, as compared with £57,717 for the previous year. The final dividend of 11½ per cent makes a total of 20 per cent for the year (25 per cent).

The nominal capital of **John Prentice (London) Ltd.**, manufacturers of goods connected with the chemistry trade, etc., 4, Staple Inn, W.C.1, has been increased beyond the registered capital of £5000 by the addition of £25,000.

Scottish Agricultural Industries, Ltd. (controlled by I.C.I.) report that for the year ended June 30 last dividends and other revenue amounted to £134,420, as compared with £134,946 for the previous year. The ordinary dividend remains at 6½ per cent.

Net profit of £32,637—as compared with £32,240 for the previous year—is reported by **W. & H. M. Goulding, Ltd.**, for the year ended June 30 last. The final dividend of 3 per cent. makes a total of 6 per cent., which is the same as before.

New Companies Registered

Newtown Paint & Chemical Company, Ltd. (422,144).—Private company. Capital £1,000 in £1 shares. Directors: H. J. Gilmour; Mrs. D. Gilmour. Registered office: 30, St. Marks Road, Mitcham, Surrey.

Controlled Heat-Treatments, Ltd. (422,026).—Private company. Capital £100 in £1 shares. Thermal treatment of metals, etc. Directors: J. H. Folkes; S. J. Smith. Registered office: Dudley Road, Lye, Stourbridge.

B. & D. Products (Thurrock) Ltd. (421,683).—Private company. Capital £1000 in £1 shares. Manufacturers of cellulose wax polishes and chemical products of all kinds, etc. Directors: H. W. J. Dunning; R. J. Grimes, The Old Vicarage, Grays, Essex.

Ever Ready Fertilisers, Ltd. (421,938).—Private company. Capital £100 in £1 shares. Dealers in and manufacturers of artificial manure and fertilisers, etc. Subscribers: F. Lawrence: F. W. Stevens. Registered office: Bowmans Place, Holloway, London, N.7.

Aimer Products, Ltd. (421,867).—Private company. Capital £2000 in £1 shares. Glass blowers, manufacturers of and dealers in glassware and proprietary articles, chemists, etc. Subscribers: E. J. J. Oldham, A. B Dale. Registered office: 71 Moorgate, London, E.C.2.

Water Treatments Ltd. (422,184).—Private company. Registered October 23. Capital £2500 in £1 shares. Water supply engineers, well sinkers, manufacturing chemists, etc. Subscribers: J. H. Money; C. H. Loveridge. Registered office: Brook House, Brook Green Road, W.6.

Humpherson & Sons (Fertilisers) Ltd. (421,553).—Private company. Capital £2000 in £1 shares. Manufacturers and importers of and dealers in natural and chemical fertilisers, etc. Subscribers: C. A. Tingey; G. L. Hall. Solicitors: Hyman Stone and Co., 87 Fargate, Sheffield, 1.

Gelatine & Produce (Longacre) Ltd. (422,123).—Private company. Capital £3000 in £1 shares. Manufacturers, importers and exporters of and dealers in gelatine, gelatine products, essential oils and allied chemicals, etc. Directors: H. Brunner; L. R. Shaw. Registered office: 2, Broad Street Place, E.C.2.

Cobra (Wood Treatment) Ltd. (421,876).—Private company. Capital £4000 in £1 shares. Impregnators and re-impregnators of wood and timber, dealers in chemicals, acids and wood preservatives, etc. Directors: W. E. Wolff; L. Magnus. Registered office: c/o Herbert Oppenheimer, Nathan and Vandyk, 20 Copthall Avenue, London, E.C.2.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

DUALLOYS, LTD., London, W., dealers in alloys. (M., 2/11/46.) October 1, £52,500 charge, to Heritable Securities and Mortgage Investment Association, Ltd.; charged on land with factory premises, cottage and other buildings thereon at Salmon Lane, Bridgewater. *Nil. October 16, 1945.

Satisfactions

ELEPHANT CHEMICAL CO., LTD., London, S.E. (M.S., 2/11/46.) Satisfaction October 8, £7500, registered September 17, 1936.

Chemical and Allied Stocks and Shares

ALTHOUGH the broadening investment demand for industrial, bank and insurance shares which followed the general advance in British Funds has been less in evidence, stock markets were firms. Consols 2½ per cent came in for moderate profit-taking and various other gilt-edged stocks lost a small part of their recent big gains. later, however, buying interest strengthened, but was more selective, particularly in the industrial section.

In accordance with the general trend,

shares of chemical and kindred companies showed further gains on balance, although best levels touched were not fully held. Dunlop Rubber after a further advance, eased to 71s. 9d., while Imperial Chemical at 42s. 6d. were slightly below the highest level touched earlier in the week. Yielding fully 3¾ per cent at their current price, Imperial Chemical offer a yield which compares favourably with the return on a large number of other leading industrial shares, and there is general confidence that the 8 per cent dividend basis which has ruled for many years will be maintained. B. Laporte remained at 94s. 4½d. Fisons were good at 56s. 6d., British Drug strengthened to 54s. 4½d., and Greeff Chemicals 5s. ordinary moved up to 12s.

Colliery shares continued to attract considerable attention, partly on the view that forthcoming results are likely to show a less conservative dividend payment than during the war period. Bolsover were 68s. 3d., Staveley 57s. 9d., Shipley 45s. 9d., and Powell Duffryn 25s. 7½d. Iron and steels moved moderately higher with Guest Keen 43s. 3d., Dorman Long 26s. 3d., and Stewarts & Lloyds rose to 52s. 3d. Suggestions that the steel shortage is likely to increase demand for aluminium castings and alloys drew attention to Birmid Industries, which rose 2s. 6d. to 93s. 9d., while James Booth were 74s. 4½d., and British Aluminium gained 1s. at 42s. 6d. Talk of a possible increase in the interim dividend strengthened United Molasses to 53s. 6d., and in other directions, De La Rue were good, further advancing to £13½ in anticipation of the "splitting" of the £1 shares into four of 5s. each. Awaiting the dividend announcement, Lever & Unilever became firmer at 50s., and among paint shares Lewis Berger moved higher on hopes of an increase in the forthcoming dividend. Goodlass Wall improved to 31s. 1½d., and Pinchin Johnson to 46s. 3d.

Associated Cement were good at 65s. 9d., with British Plaster Board 5s. ordinary 33s., and Turner & Newall at 85s. 6d. attracted on hopes of a higher dividend for the past financial year. Murex have been firm at 93s. 9d on further consideration of the results. Distillers at 133s. 6d. failed to hold best levels, and Triplex Glass 10s. ordinary were hesitant at 34s. waiting the full results and chairman's annual statement. Textile shares continued to attract more attention, but British Celanese, after touching 34s. 9d., came back to 34s.; Courtaulds were 53s. 3d., Bradford Dyers 25s., Bleachers 13s. 6d., and Calico Printers 24s. 9d. In other directions Major & Co.'s 2s. shares changed hands around 5s.

Boots Drug 5s. ordinary at 60s. 6d. have continued to participate in the upward trend among leading industrials. Beechams deferred were 26s. 9d., Sangers 33s. 6d., and Timothy Whites 44s. William Blythe 3s. shares have been more active with dealings ranging up to 15s. on higher dividend estimates based on the increase already made in the interim payment. Blythe Colour 4s. ordinary strengthened to 46s. at which there is a yield of over 4¼ per cent on the basis of last year's 50 per cent dividend. Oils have been inclined to lose ground, Shell, Anglo-Iranian, and other leaders easing a few pence, but C. C. Wakefield rose to 69s.

British Chemical Prices

Market Reports

FIRM price conditions have been reported in pretty well all sections of the London industrial chemical market this week, although there have been no important changes in quotations. There has been no appreciable improvement in the supply position and tightness persists for spot or near delivery dates. Existing contracts are being drawn against steadily and new bookings on home and export account have been on a fair scale. Among the soda products a steady demand has been maintained for caustic soda, hyposulphite of soda, and the soda phosphates. The potash chemicals are strong and available parcels are promptly absorbed. Elsewhere, barium chloride, arsenic, formaldehyde, and sal-ammoniac are in good call, while a ready market awaits offers of acetic acid, tartaric acid, citric acid and oxalic acid. The tar products market shows little alteration, and a steady demand is maintained throughout. with pitch very firm.

MANCHESTER.—There has been a fair flow of new inquiry for both light and heavy chemicals on the Manchester market during the past week and this has resulted in further additions to order-books, business including some on export account. The outstanding feature of trade locally, however, has been the persistent call for actual deliveries of a wide range of materials already bought, including textile bleaching, dyeing, and finishing chemicals, for which specifications are circulating regularly. Pretty well all sections of the market are firm in undertone. Basic slag and one or two other fertilisers are meeting with a steady demand, while it is reported that there is a brisk movement into consumption of most of the tar products, including pitch, crude tar, creosote oil, and carbolic acid.

GLASGOW.—Business in the Scottish heavy chemical market during the past week has shown little change. The normal amount of business has passed for both spot and contract trade. Prices have shown a tendency to rise. Export business remains steady.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Purification of organic chemicals.—American Cyanamid Co. 28782.

Purification of sugar solution.—American Cyanamid Co. 28782.

Detergent compositions.—American Cyanamid Co. 28783-6.

Cutting oils.—C. Arnold. (Standard Oil Development Co.) 29167.

Oils.—C. Arnold. (Standard Oil Development Co.) 29168.

Cutting Oils.—J. C. Arnold. (Standard Oil Development Co.) 29166.

Electro-deposition of chromium.—P. Berger. 28482.

Refractory substances.—Birmingham Small Arms Co., Ltd., P. H. Lawrence, E. Bates, and A. Deacon. 29024-5.

Cellulosic films, etc.—British Cellophane, Ltd., W. Berry, and C. R. Oswin. 28713.

Resins dispersions.—British Cellophane, Ltd., W. Berry, and C. R. Oswin. 28713.

Treatment of cast iron.—Chromium Mining & Smelting Corporation, Ltd. 29157.

Amines.—Ciba, Ltd. 28556-7.

Dyestuffs.—Ciba, Ltd. 28558.

Nitrogen compounds.—Ciba, Ltd. 29108.

Removal of sulphur compounds.—L. J. Derham, and F. J. Johnson. 28715.

Tocopherols.—Distillation Products, Inc. 28519.

Butan derivatives.—Distillers Co., Ltd., and T. Henshall. 28967.

Streptomycin solutions.—Distillers Co., Ltd., P. D. Coppock, and J. F. Short. 28667.

Acrolein.—Distillers Co., Ltd., E. P. Goodins, and D. J. Hadley. 28883.

Polymeric materials.—E.I. Du Pont de Nemours & Co. 28624.

Mordanting dyeings.—J. R. Geigy, A.G. 28614.

Trihalogenoethane.—Geigy Co., Ltd., I. E. Balaban, and F. K. Sutcliffe, 29071.

Settling tanks.—C. J. Hartley. 29059.

Alloys.—R. A. A. Jernell. 28709.

Separation of minerals.—Kitson & Co., Ltd., and E. A. Knapp. 28731.

Aldehydes.—Merck & Co., Inc. 28760.

Amino acids.—Merck & Co., Inc. 28761.

Riboflavin.—Merck & Co., Inc. 29057.

Refining of metals.—J. Miles, and J. Miles & Partners (London), Ltd. 28979.

Selenium.—N.V. Philips' Gloeilampenfabrieken. 28911.

Analytical balances.—L. Oertling, Ltd., and E. R. Etherington. 29022.

Fluorescent materials.—Orbit Electrical Co., Ltd., and H. J. Thomas. 29073.

Artificial resins.—Quaker Oats Co. 28664.

Cysteid preparations.—Roche Products, Ltd. 28751-2.

Pentaenes.—Roche Products, Ltd. (F. Hoffmann-La Roche & Co., A.G.) 28500.

Metallising asbestos.—Schori Metallising Process, Ltd., A. J. Dyke, and F. A. Rivett. 29154.

Light diffusing surfaces.—E. Simms, and I.C.I., Ltd. 28623.

Resinous anion-exchanger products.—Soc. l'Auxiliare des Chemins de Fer et de l'Industrie. 28970.

Metal degreasing.—Solvents Research, Ltd., and N. Drey. 28862.

Polymeric materials.—W. H. Stephens, and J. G. N. Drewitt. 28677.

Magnetic alloys.—Telegraph Construction & Mainteance Co., Ltd., W. F. Randall, and H. H. Scholefield. 28585.

Polymerised ethylene.—Telegraph Construction & Maintenance Co., Ltd., H. F. Wilson, and B. Allwright. 28983.

Flotation equipment.—A. P. Thurston. (Owens-Corning Fiberglas Corporation.) 28537.

Adsorption apparatus.—Union Oil Co. of California. 28538.

Hydrocarbons.—United States Rubber Co. 28679.

Storage vessels.—Whessoe, Ltd., and A. F. G. Austin. 28790.

Material impregnation.—P. Wilderman. 28511.

Varnishes.—P. Wildeman. 28512.

Adhesives.—P. Wilderman. 28642.

Filters.—U. A. F. Williamson. 28575

Deposition of metals.—C. C. Wood. 29014.

Colouring process.—A. M. Wooler, and I.C.I., Ltd. 28907.

Rust-removing processes.—H. Wunderlich. 28587.

Complete Specifications Open to Public Inspection

Manufacture of β-naphthaselenazole compounds.—Kodak, Ltd. March 31, 1945. 8400/46.

Process and apparatus for making carbon black.—Phillips Petroleum Co. Nov. 6, 1944. 25415/46.

Cellular glass.—Pittsburgh Corning Corporation. March 31, 1945. 9620/46.

Processes for extracting magnesia from magnesium salts in aqueous solutions.—J. C. Séailles. Dec. 13, 1939. 25525/46.

Manufacture of aluminous cements, with special reference to white aluminous cement. J. C. Séailles. April 25, 1939. 25528/46.

Manufacture of a plastic material to be used as substitute for natural leather and material obtained.—J. Seraphin. May 15, 1940. 25772/46.

Processes for extracting and concentrating sulphur dioxide.—S.A. des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny, & Cirey. Dec. 27, 1940. 25422/46.

Manufacture of varnish compositions.—Soc. des Usines Chimiques Rhône-Poulenc. April 22, 1941. 25459/46.

Varnish composition.—Soc. des Usines Chimiques Rhône-Poulenc. Aug. 4, 1942. 25825/46.

Treatment of boiler feed water.—Soc. l'Auxiliaire des Chemins de Fer et de l'Industrie, and L .F. Armand. May 7, 1942. 25794/46.

Manufacture and use, for example in steam boilers, of anti-scale and corrosion compositions derived from peat.—Soc. l'Auxiliaire des Chemins de Fer et de l'Industrie, and L. F. Armand. May 23, 1942. 25795/46.

Production of alkylated aromatic hydrocarbons —Standard Oil Development Co. June 19, 1941. 22876/44.

Separating Materials.—Technische Physik A.G. March 31, 1945. 8950/46.

Process for producing volatile hydrocarbons from hydrocarbonaceous solids.—Universal Oil Products Co. March 18, 1944. 25412/46.

Catalyst and process for synthesising organic compounds.—Universal Oil Products Co. May 31, 1939. 25413/46.

Complete Specifications Accepted

Solidifying normally liquid hydrocarbons. —D. M. Clark. (Safety Fuel, Inc.) Feb. 8, 1944. 580,885.

Process for drying alcohol-wet polyvinyl alcohol.—E.I. Du Pont de Nemours & Co. Sept. 2, 1943. 580,899.

Manufacture of catalyst compositions and their application in the syntheses of vinyl fluorides.—E.I. Du Pont de Nemours & Co. Oct. 29, 1943. 580,910.

Manufacture of vinyl cyanide.—E.I Du Pont de Nemours & Co., C. R. Harris, and W. C. Sharples. July 13, 1944. 581,035.

Manufacture of fatty acid aryl hydrazide sulphonic acids.—J. R. Geigy, A.G. March 3, 1944. (Addition to 547,569.) 581,076.

Magnetic or electrostatic separators for ores and similar materials.—General Electric Co., Ltd., and A. Bloch. Nov. 5, 1942. 581,004.

Recovery and utilisation of tin.—Hanson-Van Winkle-Munning Co. May 21, 1943. 580,987.

Rotary pumps and rotary fluid-pressure motors —H. R. Hill, and H. Portlock. June 23, 1944. 580,890.

Electrodeposition of tin.—I.C.I., Ltd. July 13, 1943. 581,034.

Electrodeposition of tin.—I.C.I., Ltd. July 13, 1943. 581,036.

Manufacture of hydrocyanic acid.—I.C.I., Ltd. Aug. 10, 1942. 581,003.

Supported catalyst.—E. P. Newton. (Baker & Co., Ltd.) Aug. 11, 1944. 580,897.

Process of separating tar acids from tar. —Reilly Tar & Chemical Corporation. July 19, 1943. 580,926.

Hydrocarbon alkylation products.—Shell Development Co. Feb. 22, 1943. 581,014.

Protection of refractory material and metals in contact with molten aluminium.—F. Singer (J. M. Lucas.) Nov. 20, 1944. 580,916.

Solvent extraction of hydrocarbons.—Standard Oil Development Co. Aug. 29, 1942. 581,006.

Oil retaining and dirt excluding seals for machinery shafts and bearings.—Super Oil Seals & Gaskets, Ltd., and L. A. Moxon. July 7, 1944. 580,988.

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VOL. LV No. 1428. November 9, 1946 Annual Subscription 21s. Overseas 26s.

Costs and Costing

DURING the war most firms were living in a fool's paradise. Cost did not matter; production was everything. It is easy enough to get very high rates of production if no attention need be paid to the cost. In the 1914-18 war the then Minister of Munitions showed how production could be stepped up in a quite remarkable way by the outpouring of unlimited amounts of money. The "cost-plus" system which was used so largely during the late war, but which was condemned by committees of inquiry, did not encourage production costs to be kept down to the lowest figure; quite the reverse. Even where there was a cost investigation the comparison was not made between a particular works and the "bogey" costs for efficient production; the only criterion appeared to be whether in fact legitimate costs were incorporated in the manufacturing charges.

This phase has passed, and although we are still in a sellers' market, we are coming back to competitive standards. Cost of materials has increased as a result of the war; cost of fuel has at least doubled; cost of labour has increased and is still increasing. How are these increased production costs to be met? Should they be met by increasing the selling price of the goods? That is a way in which the colliery industry has met their increased costs for labour and materials. The result of such a policy, however, can only be that those who have to pay more for commodities will themselves ask for higher wages in order to meet the increased cost and this will lead to general inflation. We are, in fact, already in an inflatory spiral. It has been pointed out that the way to meet the increased cost of coal is to use it more efficiently; this is one basis of the fuel efficiency campaign. The same belief, however, is true generally and the way to meet increased cost is through greater production efficiency. This may mean improved technical efficiency. The experience of the Fuel Efficiency Committee of the Ministry of Fuel and Power in regard to the use of coal has shown that very great increases in the efficiency with which coal and steam are used are possible in most factories, and this has led to the suspicion that similar economies can be made in other technical directions. That is a matter which concerns the technical staffs, chemical engineers, and production managers generally. It raises also the question of the yardstick by which production efficiency can be measured. Should it be

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consumption of raw materials per unit of product, or cost of labour per unit of product? The answer we suggest is that what is needed is an effective system of costing, sometimes called "cost-accounting." We dislike the term "cost accounting" and we prefer simply to call the operation "costing."

There is between the engineer and the accountant a long rivalry. The accountant exercises his craft to produce documents which are often unintelligible to the engineer, and with which the engineer profoundly disagrees. The engineer, often with every justification, holds that no accountant can successfully cost industrial operations unless he understands what is going on. If costing is to be done successfully, either the accountant must have sufficient technical knowledge of manufacturing processes to understand them, or the technician and the accountant must work together. Joint and co-operative working is probably the ideal. The lay-out and organisation of a costing system is a matter for expert advice, because much money can be wasted on costing. Essential information must be assembled; that is a matter which may involve heavy costs if it is not handled properly. In the extreme case, the works operations are built round the costing system. When that happens, and the costing system becomes the master and not the servant, an impossible situation arises which may lead to disaster. Costing should be applied to ascertain the necessary factors in the cost of manufacture, without devoting overmuch care to minor items that are without real influence. Costing is a tool, just as chemical analysis is a tool. Both are necessary if production is to be efficient, but neither should dominate production.

It is surprising how few engineers know their production costs in any detail. It is also surprising to find how few engineers include all relevant items in their costing. To some extent this is due to a mistaken idea on the part of employers that costs should never be disclosed. As one writer has put it: "In Britain we have tended to treat cost figures as being of a 'top-secret' nature." Many managers of companies refuse to let their production engineers know their costs. This, of course, is foolish, because if an engineer does not know how the final cost of his product is built up, he does not know where to look for economies. It is about as sensible as telling an engineer that he must produce goods to a specification, but refusing him access to the analyst's figures. Cost figures must not be used simply as a stick to beat the production man; if they are used in that way their value is reduced to something very small. They must be used as the basis for informed discussion as to where improvements can be made.

The degree to which costing should be carried depends on circumstances. Much depends upon the objective. The straightforward methods of accountancy will be sufficient in the first place, the ultimate cost of the product being obtained in terms of materials, steam, fuel, power, labour, maintenance, repairs, depreciation, overheads, and so forth. Where the same product is being made day after day, that should be sufficient to show where the major costs fall. But it may be necessary to analyse certain items of these costs in more detail, and this may involve a full-scale efficiency test to provide the figures. Obviously cost analysis can be carried to any desired extent according to the labour and expense that can be permitted to get the necessary figures. Costing by the straightforward methods of normal accountancy will be found to be of great value, provided that the figures are given to the man in charge and discussed by him and the accountant. We understand that the Ministry of Fuel and Power has in course of publication a bulletin on costing which should be of the greatest value to those who have not hitherto given much thought to the subject.

Cost analysis can go farther than this, however. The methods of statistical analysis can be applied to costing. Much useful information is contained in data which cannot be uncovered by the normal accountancy methods and which require statistical methods for their extraction. There are many factors which can disturb the normal production costs: mistakes, breakdowns, abnormal waste, errors, variations in quality of raw material, etc., and as a result the costs per unit taken at repeated intervals over a period do not lie on a straight line. Statistical analysis is necessary to interpret these variations. Engineers can learn to use this method, but it is best that they should leave it to the accountant, and devote their energies to the practical problems of production.

We thus arrive at the conclusion—with which everyone may not agree—that the engineer should collect the data and should collaborate with the accountant in working

it out by the usual methods. The accountant, however, should be responsible for the further analysis of the figures, and his conclusions should be discussed with the engineer, who will be able to say at once whether they are reasonable and practical or not. The collection of a reasonable amount of data for cost analysis is at least as important as the collection of samples for chemical analysis. Data from the costing department must be handled in precisely the same way as data from the laboratory, namely, communicated to those whom it concerns on the production side and used by them in collaboration with the management to reduce costs in order to offset the increasing prices of raw materials and the increasing cost of labour.

NOTES AND COMMENTS

"Britain Can Make It"

JUDGED by the daily attendances of the public, the "Britain Can Make It" exhibition at the Victoria and Albert Museum, London, has proved an undoubted success, and many will welcome the announcement that the closing date has been extended until December 31. At the same time, there will be a certain amount of disappointment over the decision to dismantle the exhibition then, instead of sending it on tour. This will be especially the feeling in Scotland, whose claims were pressed particularly. However, the Council of Industrial Design, who organised the exhibition, point out that March is the latest suitable date for a showing in Scotland and, to go to Glasgow, the exhibition would have to close in London on November 24 since dismantling and re-erection would require more than three months. The cost of moving and administering the exhibition for a month might well reach £150,000, and very substantial amounts of timber and fabric would be needed for renewals. Similar considerations affect any proposal to move the exhibition to a provincial centre in England or Wales. By remaining open in London until the end of 1946, the exhibition could not open elsewhere until the end of April, nine months after the date when most goods were submitted, and a few weeks before the opening of the British Industries Fair, when the exhibition would have lost its interest for manufacturers, and home and overseas buyers. It is hoped to make arrangements later on with the railways for the running of special excursions from Scotland and provincial centres. The technical difficulties, the cost involved, and the inevitable lapse of time are considered too great to justify the Government in sending the exhibition overseas. A welcome innovation is that as from next week the exhibition will be closed to the public on Friday mornings so that directors, managers, and buyers of industrial and commercial establishments can obtain admission on presentation of their business cards, from 9.15 a.m. onwards.

Radio and Science

ONE of the questions discussed at the Royal Society's Empire Scientific Conference in July was the dissemination of scientific information (*see* THE CHEMICAL AGE, July 13, p. 33). The stress then was on the manner in which scientific news is presented by the Press, criticism being expressed regarding the development by certain scientific publications of a "slang" almost unintelligible to experts and completely so to laymen. Another aspect of the same question—the publicising of science by radio—gave rise to an interesting discussion at a recent meeting of the London and South-Eastern Counties Section of the Royal Institute of Chemistry. Dr. W. E. van Heyningen claimed that the necessity for publicising or popularising science had existed long before the atomic bomb, which had only accentuated it and made a wider circle of scientists aware of their responsibilities to society. The atomic bomb and other wartime developments had made science unpopular in certain circles, he said, and to that extent antagonism as well as ignorance must be overcome. It was suggested that satisfactory science broadcasting would be attained only when the B.B.C. (a) appointed a full-time Director of Science Broadcasts, responsible for long-range strategy, and understanding all aspects of science, including its social function, and having the confidence of his fellow-scientists and of the public; (b) retained a consulting panel of specialists; and (c) employed a staff of producers devoting full time to science broadcasts. The general feeling of the meeting was that the

scope of the broadcasts should be as wide as possible and that they should be simple in style and expression.

The Mind of a Machine

AN electronic brain, capable of carrying out functions such as the semi-automatic parts of the human brain perform for us, certainly strikes us as a "Wellsian" conception. But the stage is already set for its development, according to Admiral Lord Mountbatten of Burma who, speaking as president of the British Institution of Radio Engineers at the twenty-first anniversary dinner, described its possibilities. This robot with a mind of its own would, of course, be operated by radio valves, activating each other in the manner of cells. An example of such a machine is the electronic numeral integrator and computor—Eniac—which is worked by 18,000 valves. A machine of this kind receives information from a number of systems and, functioning in accordance with overall directions given to it by human beings—even from a distance—is claimed to be capable of providing solutions of abstruse mathematical problems in a fraction of the time which would be taken by a human mathematician. Machines are in use which go even further and, it is claimed, exercise a degree of memory, while others are being devised which are expected to be capable of making a choice and coming to a judgment. With such mechanical phenomena in prospect, science would certainly seem to be facing a new revolution; and Lord Louis was not exaggerating when he spoke of the responsibilities confronting scientists as "formidable and serious."

Nearly Human

THIS latest machine can with certainty be called a robot. It deserves the name more than the machines of metal built in grotesque human form, which for years have been one of the sights of pseudo-scientific exhibitions. These metal machines could only move their limbs, in response to commands; they could not think, nor could they remember. They had no brain. But the new man-made mind is truly a robot in that it is obedient and intelligent, and, alas, completely impersonal. It is claimed that the machine can play a mediocre game of chess. If this claim is put forward to show its human side, it is an unfortunate choice. Everyone knows chess to be a methodical, cold and passionless game. It is a game where the human emotions are never aroused. If it had been said that the machine could hold its own in a cut-throat poker school, or give some aid to a harassed penny pools contestant, then people would have welcomed it, and acclaimed it almost human. As it is, because of its extra-human powers in coldly solving fantastic mathematical problems we hope it may be able to give some help to the Chancellor of the Exchequer in working out the extent of our national debt.

Peanuts in East Africa

BRITAIN'S chemical and paint industries may benefit if the proposal to produce ground nuts on a large scale in East Africa is approved by the Government and is carried through. Oil from these nuts will be used to eke out the world supply of edible fats. Industry will benefit indirectly through the release to it of certain other oils, *e.g.*, linseed oil, which are at present being used as food owing to the shortage of fats. The project for the production of ground nuts in East Africa was put forward by a commission which was appointed by the Colonial Office four or five months ago to survey the prospects of cultivating such a crop in certain parts of the British Empire. They reported "extremely promising" prospects for East Africa, and suggested that if quick action were taken it might be possible to reap the first harvest next year. Because large capital expenditure would be required to launch the scheme, it was suggested that the British Government should finance it. The project is a long-term one, as it is not considered there is much likelihood of a fall in demand for vegetable oils for a considerable time. If the scheme goes through, ground nuts will be grown in Tanganyika, Rhodesia, and Kenya, in addition to Nigeria, which has hitherto been the chief colonial source of the nuts.

The first all-aluminium bridge span in history has been installed on the new Grasse River bridge of the Massena Terminal Railroad at Massena, New York. It was designed by the Aluminium Company of America and built entirely of Alcoa aluminium alloys. The 100-ft. span weighs only 53,000 lb., as compared with 128,000 lb. for similar steel spans.

Growtn-Regulating Substances

Their Chemistry and Development

by T. SWARBRICK, M.A., Ph.D.*

GROWTH-REGULATING substances are not mysterious vital forces, they are definite chemical materials. For our present purpose which is to stress the chemical aspects of this new scientific development, a growth regulating substance may be defined as "a substance which although present in minute amount, has specific influences upon the growth and differentiation of living tissues, thereby controlling their subsequent development in some way other than by direct nutritive means."

Particular emphasis must be placed upon two important factors in this definition. The first is the small amount of active substance that is required to produce the ultimate response. At first sight it might appear that some sort of enzyme action is involved, but this is not so, for, it is recognised, an enzyme merely accelerates the speed of a reaction that will proceed slowly without it. But with growth-regulating substances it is different; without them there is chaos, with them organised growth and development proceeds. The amount required must usually be reckoned in parts per million. An excess may be as harmful as complete absence. The second factor is that we are concerned with the effect of substances upon the development of the living organism. These substances lose all their importance as soon as the organism is dead. When present, they direct living processes along the familiar channels.

Chemical Analysis Problems

It is precisely at this point that the main difficulty of our investigation lies. It is both difficult and costly to examine large quantities of complex plant and animal material for the presence of unknown substances which at most are present at one or two parts per million. Furthermore, there are no known methods of direct chemical analysis for many of the substances known to act as growth regulators. Biological assay is the only method at present available and even this must be used with caution. In view of the many difficulties and the fact that it was not until 1910 that the first heat-stable plant-growth regulating substance was isolated and its effect demonstrated, our advance has been phenomenal. It is now known that there are over one hundred chemicals which can act as plant-growth regulators, and the number is increasing as more workers turn their attention to this new field of knowledge.

* Of the Shell Petroleum Co., Ltd., London.

The majority of the known plant-growth regulating substances fall into a fairly well-defined group of organic compounds, but there are notable exceptions. The "naturally" occurring substances are the various indole and phenyl compounds while the synthetic ones are mainly substituted benzoic acid and phenoxy compounds. The most notable exception to this general list is a synthetic œstrogen, dihydroxy-diethyl stilbene, which does not contain either a carboxyl group or chlorine, and only one double bond.

Surface Phenomena

It is not surprising that various theories have been advanced to account for the observed physiological activity of these numerous substances. Unfortunately no one single theory will account for all the known phenomena, and it is the present writer's considered opinion that chemistry alone does not provide the answer to our problem. It was mentioned earlier that these substances are important only so long as the plant is alive, and therefore capable of responding to the stimulus. It is becoming increasingly clear that living processes are essentially surface phenomena, that is the various reactions take place at solid/liquid or immiscible liquid interfaces. The production of a satisfactory theory must therefore wait upon the advancement of our knowledge of orientated reactions taking place within the peculiar conditions that prevail in surface layers, as distinct from chemical reactions taking place *in vitro*. In fact, we are here concerned not so much with the composition of the molecule as its shape, its molecular weight, its spatial configuration, and its polarity or free electrical energy.

The importance of molecular shape, or isomerism, as distinct from percentage composition can be illustrated by the following examples. The substance 2-4 dichlorophenoxy acetic acid is highly physiologically active. Using young tomato plants about 6 in. high, the presence of this material can be detected down to one part in ten million parts of water. A further refinement in technique should enable us to detect even lower concentrations. At one or two parts per million 2-4 D. (as it is known) will induce the parthenocarpic development of unfertilised tomato flowers. At one hundred parts per million it will induce undesirable "formative" effects, and at one thousand parts per million it is lethal to a wide range of plants, while others are hardly affected at all. Because of this

latter quality, 2-4 D. has now become the basis of what are known as "differential" weed-killers, and one firm alone in the U.S.A. has this year manufactured and sold over three million pounds of 2-4 D. for use as a weed-killer—sufficient for the treatment of three million acres of land. In England, I.C.I. have developed a modification of 2-4 D. which is now marketed under the trade name of Agroxone. The active chemical in this preparation is 2-methyl 4-chloro phenoxy acetic acid. The production of this material instead of the 2-4 D. is no doubt prompted by the fact that it can be made from facilities and raw materials available in England. But from our present point of view the important fact is that the substitution of a methyl group for the chlorine atom in the 'two' position on the ring does not materially alter its physiological activity. But 2-chloro 4-methyl phenoxy acetic acid, produced by substituting the chlorine in the "four" position by a methyl group, is physiologically almost inactive. It is certainly not nearly such a good weed-killer as the 2-methyl 4-chloro material. Both these substances have the same chemical composition but a different spatial arrangement, and very different properties.

Effect of Related Chemicals

That it is no longer possible to look to chemistry alone for an understanding of our problem is also shown by the fact that α naphthalene acetic acid will prevent pre-harvest fruit drop when applied to fruit trees at 10-15 p.p.m by an effect upon the abscission layer, whereas β-naphthalene acetic acid is useless for this purpose. Furthermore, increasing the dose rate beyond this amount does not increase the response. Similarly, α-naphthalene acetic acid will inhibit the sprouting of potatoes so that they can be stored well into summer without risk of deterioration from sprouting. The β-compound is almost useless for this purpose. Storage methods based on the use of α-naphthalene acetic acid and costing about 8d. per cwt. are now commercial practice in the U.S.A. and Holland, but for some reason have not been adopted in England in spite of the fact that some of the original work on which this method is based was done in this country by the writer during the early war period. For the parthenocarpic production of tomatoes, β-naphthoxy-acetic acid is highly effective, whereas the α-compound is useless. Examples could be multiplied almost indefinitely but the high physiological activity of the γ-isomers of DDT and Gammexane may be mentioned.

Furthermore, it is well known to workers in this field that if the acid, *e.g.*, α-naphthalene acetic acid, is physiologically active, then the potassium, sodium, and ammonium salts, the methyl and ethyl esters, the amides, and frequently the nitriles, will also be physiologically active, but will require to be used at higher concentrations in order to compensate for their higher molecular weight. The fact that the salts, esters, and amides of a particular nucleus are physiologically active has important applications in commerce. The potassium, sodium, and ammonium salts are water-soluble, the esters are soluble in organic solvents and mineral oils, and the amides are more easily compounded in dust, etc. The manufacturer can therefore choose a form suitable for his particular purpose.

These considerations raise the whole question of "specificity" as regards insecticides, fungicides, and plant-growth regulating substances. The introduction of DDT has done more than anything to focus our attention on the problem of specificity, and intensive research is in progress all over the world to uncover the nature of this action. In fact, conservative entomologists and chemists regard DDT as the first of a whole series of new chemicals that will be "specific" against a particular insect or narrow group of insects. Indeed, materials are now being developed in the U.S.A. which are reported to be active against certain insects at lower concentrations than DDT at its best. Even DDT shows marked specificity. Two recent cases must suffice. There are apparently two races of asparagus beetle in the U.S.A. which the insect taxonomists cannot distinguish with certainty. One is easily controlled by DDT, the other is not. DDT does not control the Mexican Bean beetle yet this pest is easily controlled by a slightly modified DDT molecule. Indeed this latter material, which is still undergoing trial in the U.S.A., is the first one to offer any real promise of commercial development for the control of this important pest.

Molecular Structure

Recent research by the writer has also served to emphasis the importance of shape and the free energy relationships of the molecule as distinct from its percentage chemical composition. It was found that the synthetic œstrogen, dihydroxy diethyl stilbene, will induce the parthenocarpic production of tomato fruits. In this respect it falls into the same class as the chlorine-substituted phenoxy compounds.

From the theoretical standpoint this is an important observation since stilbœstrol is a symmetrical molecule, contains two phenolic OH groups, and does not contain a carboxyl group nor any chlorine. In fact, except for the two OH groups in the phenolic position it is a hydrocarbon, and in this respect it is very much like the indole and phenyl compounds which were the first plant-growth regulating substances to be isolated from plant material. It is interesting to note that since the writer pointed out that di-

hydroxy diethyl stilbene could be used as a plant-growth regulating substance, American workers have shown that the methyl and ethyl esters are also physiologically active. The material, therefore, in this respect, falls into line with other growth-regulating substances.

What are the important practical aspects of growth-regulating substances? Many famous botanists, *e.g.*, Sachs, Darwin, Loeb, and others all postulated the existence of "root-forming," "stem-forming," and "flower-forming" substances without being able to isolate or demonstrate them. Now we have over one hundred chemicals each of which can be used for a specific purpose. But of these only a few can be used commercially because we have not yet learnt how to formulate the majority for this purpose. Much of the difficulty lies in the specific nature of the response they engender, and in the determination of the proper concentration at which to use them. Take root development, for an example. The most versatile single substance for this purpose is indole butyric acid, yet for rooting evergreens (holly and privet, etc.) α-naphthalene acetic acid is the best single substance. Recent research, however, shows that for the most satisfactory results a mixture of two or more substances is required, but the problem is: which materials and in what proportions? Until we can get a better understanding of the physiology of these materials, the right proportions must be determined by the laborious method of trial and error. Mixtures of substances are also indicated in other branches of the work. It is well known that α-naphthalene acetic acid is the only satisfactory material for the prevention of pre-harvest fruit drop. Some varieties of apple, however, have a short period of duration of effect, but recent research has shown that in those varieties the effective period may be prolonged by the use of a second substance at not more than 5 parts per million. Commercial growers may therefore expect improved commercial formulations in the near future when these experiments are concluded.

Undesirable Changes

The undesirable effects of 2-4 D., when applied to tomato plants at concentrations of 100 p.p.m. or more, have been mentioned earlier. 2-3-5-tri-iodobenzoic acid also has somewhat similar effects which require further study. This substance, when vaporised in the presence of young tomato plants, causes the subsequent shoots which arise in the leaf axils to be flower shoots instead of leafy shoots. 2-3-5-tri-iodobenzoic acid is in fact the first "flower-forming" substance shown to be specific for this purpose. Even this material cannot yet be formulated for use on a commercial scale, but it points the way to future developments.

More far reaching still is the possible connection between growth-regulating substances, virus diseases, vitamins, and the oxidation-reduction systems of the living organism. It was mentioned earlier that living processes are controlled oxidation-reduction processes taking place within a surface membrane. Growth regulating substances are somehow involved in these systems and it is interesting to note in passing that many of the substances known to be growth regulators will act as oxygen or hydrogen acceptors or donators depending upon the conditions in which they find themselves. It is only recently that the substances associated with virus diseases have been isolated in a pure state, and it will be interesting to see what these materials are chemically.

Toxin Similarity

The boundary line between plant physiology, plant pathology, organic chemistry, and colloidal physics is rapidly disappearing. Even in plant pathology it has been shown that the disastrous and economically serious consequences of certain pathogenic organisms are due to small quantities of the "toxins" or by-products which they produce. When these toxins are rendered inactive by the use of some chemical with which they will combine to form an innocuous substance, the plant shows no symptoms of disease despite the presence of the pathogen. Certain quinone compounds have proved particularly effective for this purpose, and active research in now in progress to discover other materials that are more satisfactory. The quinones are known to be active oxygen acceptors or donators depending upon their immediate environment.

Our present knowledge of the chemistry and physiology of growth-regulating substances is at best scanty and there are many large gaps. I have tried to indicate that the subject is part of a much larger whole involving the fields of enzyme activity, vitamins, virus diseases, the physical basis of inheritance, and even cancer research. A new science is developing which will require the active co-operation of animal and plant physiologists in association with biochemists and those rare souls who study the spatial relationships of atoms and molecules, and the orientation of molecules in a surface layer. Much of this work must remain for the present on a highly academic level, but in the meantime the chemical industry in England can contribute to our future welfare by recognising that developments along these lines may well be as revolutionary as those that have recently taken place in physics.

The Mysore Government has placed contracts in Britain for industrial equipment to the value of £500,000

The Skoda Works

Progress of Reconstruction Reviewed

(*by a Special Correspondent*)

INTERESTING details have just come to hand about the results achieved in the reconstruction of the well-known Skoda Works at Plzen (Pilsen), one of the leading units in Czechoslovakia's heavy industry, and, at the same time, one of the foremost producers of armaments and machinery of every description on the Continent.

It may be recalled that the Skoda Works were heavily bombed in the last phase of the war; in particular, the raid of April 24, 1945, in the course of which over 1000 heavy and medium bombs and some 16,000 fire bombs were dropped, had such serious consequences that only about 40 per cent of the factory buildings remained intact. Reconstruction work was put in hand immediately Plzen had been liberated by United States forces. The extent of the work may be gauged from the fact that in the second half of last year about 4745 tons of iron, 870 tons of cement and 1,320,000 bricks were used, while 3,183 trucks of scrap were removed from the ruins. In order to hasten the resumption of activities, the works staff put in over 100,000 hours of voluntary labour. As early as the first half of July, *i.e.*, two months after the city had been liberated, the reconstructed electrical foundry was again in operation and the first steel was made. The next step was the starting up of the Siemens-Martin furnaces. As a result of the resumption of output in the steel plants, work in other manufacturing departments of the concern could be started. By the end of the year, 75 per cent of essential repair work at Plzen was completed.

Further Progress

At the same time progress was made in the branch factories and subsidiary companies. For instance, the plant at Prague-Smichov, which had not been damaged at all during the war, is now fully engaged on the manufacture of Diesel engines and machine tools. The plant at Brno, which suffered severely during the siege of the town, is turning out electric equipment and the plant at Adamov, the greater part of which was ruined, has also been repaired so that the production of railway brakes and of machine tools for the Skoda works could be resumed. The factory at Hradec Kralove, in Bohemia, exclusively used for the production of war equipment, has been converted to the manufacture of industrial equipment, such as boilers and machinery for sugar plants, breweries, alcohol distilleries, as well as plant for the chemical industry. Another factory at Plotiste is employed in the manufacture of dairy equipment.

In the first four months of 1946 the electrical equipment plant at Doudlevce produced nearly 10,500 electro-motors and about 100 transformers, while in some of its branches the pre-war production level was gained by March, 1946. In Slovakia, the works at Dubnica, which had been completely destroyed by the retreating Germans, were reconstructed, by May last, to such an extent that the manufacture of materials for the construction of railway and road bridges could be begun. Later, the production of machinery was added to the plant's manufacturing programme. The shipyards at Komarno on the Danube are reported to be fully employed in the building of barges and other river craft. It is stated they will be fully employed for a long time to come.

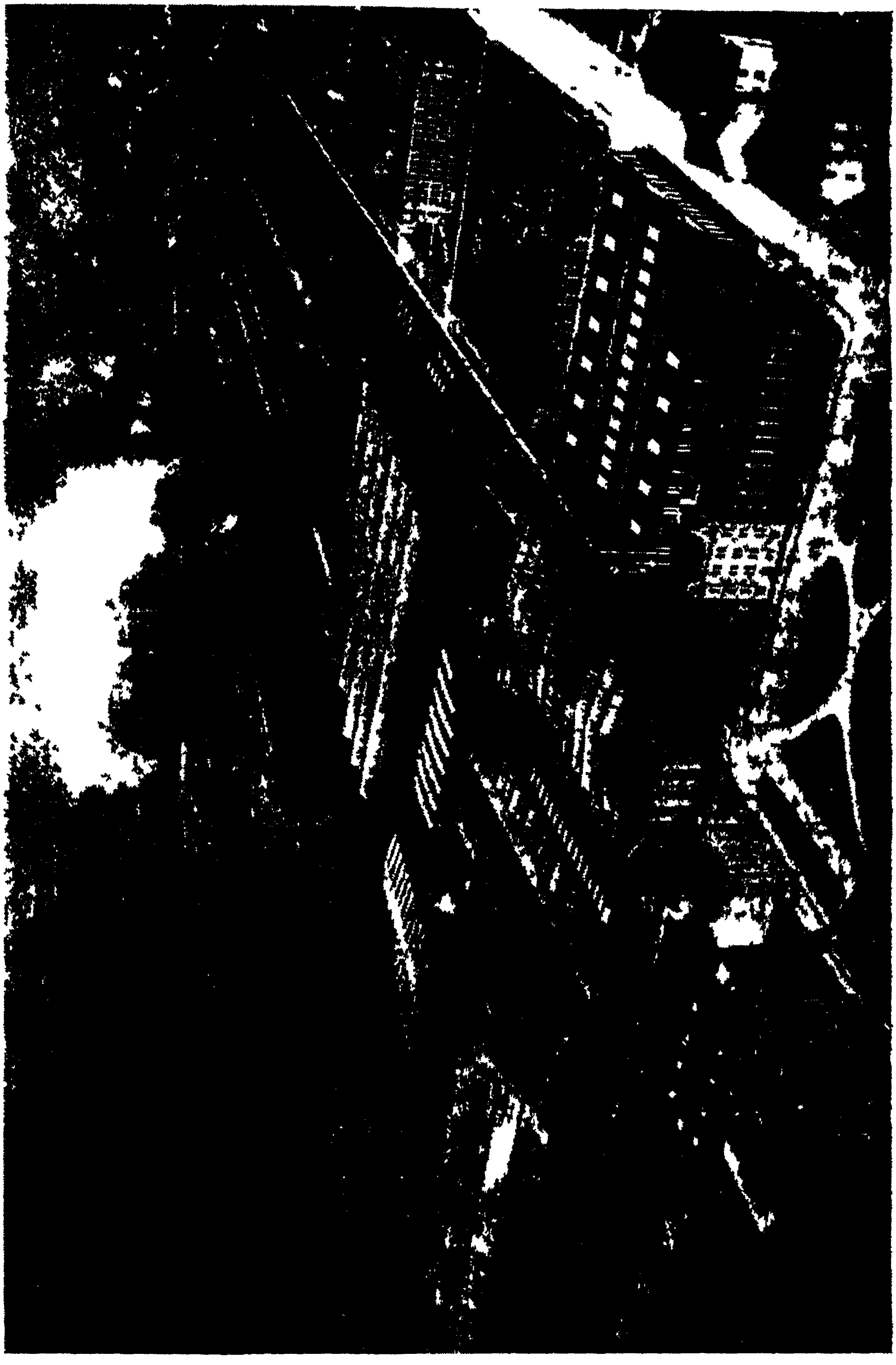
Expansion

Another important unit of the Skoda concern, the locomotive shop, which had been the target of every air raid, has not only been rebuilt, but expanded. At the beginning of this year, it produced a locomotive wholly manufactured in Czechoslovakia. According to recent advices, 47 new locomotives had been built up to the middle of August, a fact which should be of no mean importance in the reconstruction of the Central European transport system.

As regards the manufacture of machinery, an important field of activity of the Skoda Works, it is reported that a large number of items can again be supplied, while the motor car works have designed a new model, the Skoda 1101 and a new tractor, the Skoda UT28.

Employment in the Skoda Works—which have been nationalised by a decree of the Ministry of Industry of March 7, 1946—is reported to be satisfactory and orders continue to come in at an increasing rate, including inquiries from abroad. The financial position of the concern, about which no details are available as yet, appears to be strong.

A photograph of the Skoda Works, as they were seen from the air at the beginning of the war, is on the opposite page.



Digest of Statistics

Chemical and Allied Production and Consumption

PRODUCTION and consumption of various chemicals and fertilisers in the U.K. during August, as recorded in the October issue of the *Digest of Statistics* (H.M.S.O., 2s. 6d. net), showed much fluctuation. Figures quoted represent thousand tons.

Production of sulphuric acid—*i.e.*, as 70 per cent acid and including acid made at Government factories—was 150.4, a drop of 6.2 from the July figure, and of 10.9 from that for June. Consumption of sulphur for the manufacture of sulphuric acid, at 15.7, was also down from 16.6 in July, and 17.0 in June. After rising in July to 159.0 from the June figure of 152.0, consumption of sulphuric acid declined again to 154.0. Stocks of sulphur for the manufacture of sulphuric acid rose to 68.6, as compared with 56.7 for July, and 58.1 for June. Sulphuric acid stocks, however, continued to fall, the figure being 88.7 as against 89.6 and 92.7 respectively for the preceding two months.

More Superphosphate

Superphosphate production, at 75.0, showed an increase again of 1.7 over July's figure, which had dropped by 1.8 from that for June. Consumption of superphosphate, including deliveries to consumers and amounts used in compounds, was also up, the figure being 83.7, as compared with 76.1 in July, and 64.8 in June. A recovery in production of compound fertilisers, which had fallen to 80.9 and 91.7 in June and July respectively, was shown in the figure of 112.3 The increased consumption was maintained at 55.9, comparing with the previous month's rise to 53.4 from 18.9 in June. There was a rise of 4.6 in the consumption of phosphate rock for fertilisers over the July figure (54,9), which had risen by 4.5 from the preceding month's. Consumption of ammonia, including both home deliveries and export, but excluding ammonia produced in by-product factories and converted directly into ammonium sulphate, was down to 23.34 from 24.29 in July and 25.51 in June. Stocks at 4.68 were again up from 3.44 in July and 3.11 in June.

In September there was another rise in the production of iron ore, the figure being 229.0, as compared with 224.0 for August and 220.0 for July. Pig iron production in September was level again with the July figure of 147.0, which had dropped by 2.0 in August. There was also a rise in the production of steel ingots and castings which, after falling to 226.0 in July and August, were up to 238.0.

Among non-ferrous metals, total disposals of virgin copper in August were 25.0, against 26.1 in July and 23.7 in June. August stocks, at 85.1, had risen by 1.8 since July and by 4.2 since June. Disposals of virgin zinc totalled 16.7, a drop of 1.1 on the July figure, which had risen from June's total of 17.1. Consumption of zinc concentrates was down to 11.6, following July's decline of 3.2 from the June figure of 16.9; but stocks, totalling 118.0, had risen from 109.0 in July, though still below the June total of 125.0. A figure of 16.1, as compared with 17.8 in July and 16.4 in June, represented total disposals of refined lead, of which stocks amounted to 27.1, after dropping from 33.7 in June to 23.0 in July. A fall of 1.8 was shown in the total disposals of tin metal, which had risen in July to 3.97 from June's total of 2.63. Comparative figures for stocks were: August, 22.1; July, 20.0; June, 22.4.

An upward trend in the number of people employed in chemical and allied works was again indicated by the total (in thousands) for August of 231.6 (including 73.8 females) as compared with July's figure of 226.7, which had fallen off by comparison with 227.8 in June, when the first improvement in seven months was shown.

World's Largest Transparent Plastic Dome

A crystal-clear dome, 11 ft. in diameter and 4½ ft. deep, made of plastic—acclaimed the world's largest transparent "bubble"—has recently been completed in America by the E. L. Cournand Co., New York, after four months' experimenting and engineering.

A heated sheet of Rohm and Haas Plexiglas, the plastic from which noses of war bombers were made, was drawn into a vacuum pot to the required shape and cooled. Before a sufficiently large sheet could be obtained several sheets had to be joined with a bond strong enough to withstand the vacuum and the stretching. Heat-welded and cementing in an ordinary butt joint had failed. Success was achieved by routing a concave V-groove in both edges of the sheets to be joined, soaking a cast acrylic rod in monomeric methacrylate cement, and placing the softened rod between the grooved edges. The hemisphere was then mounted in an 11-ft. steel ring, allowing for expansion or contraction of the material in extreme hot or cold weather.

Buffed to a clarity equal to that of the finest optical glass and claimed to retain its shape indefinitely and to be immune to weather, the giant hemisphere is intended to contain an advertising display.

Potash Reclamation

Recovery from Ferrous and Non-Ferrous By-Products

by A. G. AREND

AS a result of potash deficits during the recent war, a number of the less vital industries were obliged to abandon their activities temporarily, and consequently a certain amount of attention was given to the problem of balancing this deficiency. Probably the most detailed accounts and statistics are derived from papers issued by the U.S. Division of Fertiliser Chemistry. From a reprint of one of these (1944) it is known that some 85,000 tons were allocated to the chemical industry, while agriculture claimed 540,000 tons; 36,000 tons were delivered in the United Kingdom, and 35,000 tons to Canada.

Although the sources of the raw material are wide and varied, the general development of methods here and in America differs considerably. The recovery of potash from blast-furnace by-products has been more popular here, whereas the reclamation from cement-kiln dust has been much more extensive in the the U.S.A. As it happens, deposits of potash-bearing felspars exist to a quite considerable extent in this country, although, despite numerous proposed processes, comparatively little of this material has been utilised. The variety of felspar known as orthoclase has been known to contain up to 16 per cent K_2O, or 13 per cent actual potassium (although this is the purest variety), and a much greater abundance exists of mineral of lower potash content. From time to time, attention has been attracted to the possibilities of recovering the potash salts, and at the same time converting the remainder to different forms of cement. A list of patents is available on this subject, but it is doubtful whether many of these have been put into regular service.

Flue-Dust Recovery

On the other hand, great success has been attained in the recovery of potash from blast-furnace flue dusts from the smelting of pig-iron, where, although the total percentage is exceedingly minute, the large daily tonnage allows this to accumulate to an appreciable figure. From earlier details, the dust recovered from the Scunthorpe plant is known to contain some 63 per cent of soluble potash salts, mainly composed of bicarbonates and carbonates, although chlorides, cyanides, formates, and sulphates were also detected. Since as much as 5.6 per cent of cyanides were present, the product necessitated careful refinement before it could be fully utilised, to ensure freedom from poisoning hazards, etc. By introducing the electrostatic precipitation process, the Skinningrove plant was enabled to offset this undesirable impurity, but carbonates were absent here, and only traces of sulphates appeared, and the dust, containing some 20 per cent of potassium as chloride, was accompanied by 8 per cent of sodium chloride. By dint of careful handling of the charges and the addition of alkali chloride,, it was claimed that as much as 70-80 per cent of the available potash salts could be volatilised, and upwards of 100 lb of potassium chloride could be recovered per million cu. ft. of gas from the blast furnaces. The total amount of potash salts originally introduced into the furnace, per ton of pig-iron produced, only amounted to 7.6 lb., in another instance. Further statistics showed that the potash capable of recovery from 100 blast furnaces per annum could amount to some 1670 tons per annum, but the cost of the operations involved was considered to render this doubtfully economical.

Mechanical Handling

Mechanical handling problems in connection with potash have resulted in the connection with potash have resulted in the use of improved forms of equipment at the few blast-furnace plants engaged on this work. Some of the salts concerned are guilty of absorbing moisture from the atmosphere and tend to convert the mass into a sloppy condition.

Even the coarser dust is removed separately from the flues, while the mains leading from the washers, although representing only a small source, have been known to contain upwards of 44.5 per cent potash Instead of giving the material any opportunity to be exposed, the conveyors into which it is discharged are equipped with wheel-mounted covers, which can be opened at any point. The discharge hopper enters into a funnel, and can be slewed so that the best possible use can be made of the existing conveyor line. In the ordinary way, however, trucks are provided with special containers of almost conical shape which are run up to receive the discharged dust, and remove it to the reclamation plant. These containers can be closed at the top, and evenly and uniformly discharged to the tanks from the bottom.

Probably most of the development in potash handling emanates from the old-established potash mines at Strasbourg, where, from long years of experience, the best type of freighter trucks have been designed (Fig. 1). These have a truncated conical top with hinged lid, and means of directly discharging into barges lying on the waterways nearby. In recent years the

conveyor lines used have been fitted with special scraper attachments, so that the plate-belt sections are enabled to have any adhering material pressed into a squared block, and completely thrust off each time the scraper comes into position. Reverting to the blast-furnace process, where spray washers connected to the stoves are used, great care has to be taken that no serious dusting losses are sustained; and recent installations of electrostatic precipitators are claimed to entrap practically all dust with the minimum need for mechanical handling. It will be observed that, as the total of 7.6 lb. of potash is available per ton of pig-iron produced, and the iron ore charge, including lime, brings this down to little more than half this quantity, only some 0.18 per cent of potash is present in the original charge. The work is thus wholly a matter of by-product recovery.

American cement manufacturers are better placed in this respect, since the raw material charged to the kilns contains upwards of 4 per cent of potash, and usually averages 6 per cent, which accounts for the lack of interest in blast-furnace reclamation in that country. Whereas the slags from the furnaces are generally guilty of retaining much of the potash, the cement process frequently permits more liberties, in that alkali chloride additions can increase the available yield. Statistics made out by K. Chance revealed that whereas some 150,000 tons were lost in the slag, only 50,000 tons were actually volatilised with the gases. The meagre proportion of potash initially present prevented attention from being devoted to improved reclamation methods.

A totally different state of affairs exists in the smelting of certain of the non-ferrous metals, particularly copper, where the use of richly siliceous slags supplants the use of the converter. The same applies in a lesser degree to nickel, and to certain of the mixed residues and concentrates smelted. In the ordinary process where a large plant lay-out is engaged, the product from the blast furnace passes to a converter for concentration. Copper matte is thereby raised to crude metallic condition, suitable for conversion to anodes for electrolytic refining. Nickel matte of some 30 per cent nickel is raised to almost pure nickel sulphide of 70 per cent nickel, by a similar process. Mixed concentrates and residues have also been subjected to converter treatment to expel the surplus sulphur, while silver-bearing copper and lead materials are concentrated in a like manner.

Converter plant, however, is justified only where there is a large and constant supply of raw material, and smaller smelters and refiners, besides those engaged in remote localities, have to revert to a slower, though almost equally successful, method of concentration. This comprises roasting the poor matte, and returning the oxidised mass to the blast furnace, together with suitable siliceous fluxes, which for convenience are frequently formed into briquettes. By so doing, even the poorest mattes can be raised to a greatly enriched condition, while the costs are little more than that of fuel and labour.

Even after 1918 poor mattes containing about 8 per cent copper, besides foul slags, were generally ignored as being worthless.

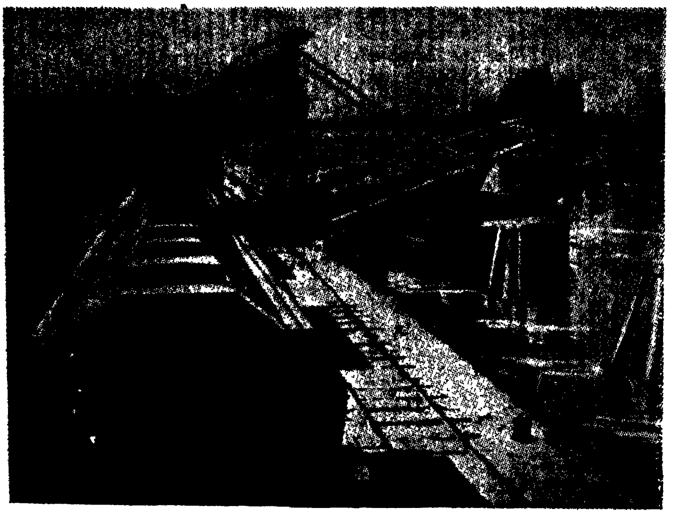


Fig. 1. Specialised types of freighter trucks used at the potash mines at Strasbourg.

One enterprising firm, however, enriched these to as much as 50 per cent copper in a single operation, following suitable roasting. Where argentiferous copper ores are handled, a similar method was developed in Argentina, where the silver was concentrated, and the bulk of the gangue material removed as slag. Siliceous fluxing additions represent the main feature of each of these processes. With silver residues, barren additions are not wanted, and efforts are made to utilise silver-bearing sands as far as possible, so that the furnace performs a dual function. It is here that the use of felspars, particularly those of the orthoclase variety, are of interest, and although their use so far has been somewhat limited, the final washing of the furnace gases permits the volatilised potash salts to be concentrated in the wash-water solution.

Application of Felspar

A typical charge comprises 20 cwt. matte, 6 cwt selected and finely pulverised felspar, and 3 cwt. slag, with a calculated addition of carbonaceous material to assist the reduction. While this suffices for reverberatory furnace smelting, a binder, besides the usual water-glass, is also added when the material is to be formed into briquettes. Ferruginous lead sulphate deposits from lixiviation tanks are a suitable addition here, and assist the easy production of good briquettes. Much care has to be bestowed on the formation of a suitable ferrous silicate slag, since in this way the potash salts are rendered most volatile. For example, a slag consisting of 32 per cent silica, 36 per cent ferrous oxide, and 32 per cent lime, will melt at about 1150° C., but this does give the potash salts the same opportunity to volatilise. A more refractory slag of less fusible disposition and containing what is generally considered an undesirable material, *viz.*, ferric oxide, instead of part of the ferrous oxide, is used. This slag is

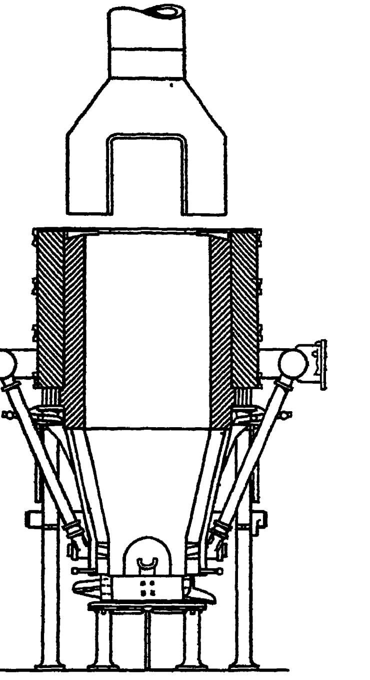


Fig. 3. Design for blast-furnace for non-ferrous metals in which, when potash-bearing fluxes are used, the heat and other conditions are manipulated to volatilise the potash.

viscous, and the lower portions of it have a greater tendency to adhere to some of the matte, so that this section requires to be returned to the furnace for re-smelting; on the other hand, the potash is not retained in the same manner as with the usual type of slag. The high temperature of the blast-furnace under these reducing conditions causes the bulk of the potash salts to pass to the flues and the scrubbing towers. Whereas the iron blast-furnace charge only contained an initial 0.18 per cent of potash, the matte concentration charge contains 3 per cent, let alone any additions obtained from the 3 cwt. of slag, which, if taken from the same process, tends to increase this proportion.

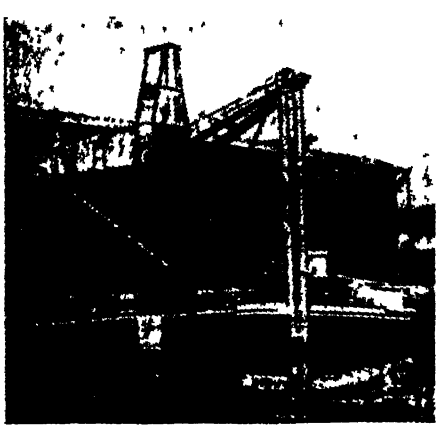


Fig. 2. The earlier type of elevator device is still employed for discharging the barges at Strasbourg.

Depending on how the charge is worked, about 80 per cent of the available potash passes to the gases without in any way interfering with the condition of the concentrated matte. If badly worked, the majority of the tapped slag frequently separates into two layers, although this cannot always be detected by the eye, but an analytical test will

reveal that the upper layer is richer in potassium. At the scrubbing towers, instead of utilising a continual flow of fresh water, water from an overhead storage tank is used repeatedly, whereby the dirty liquor becomes more and more concentrated in potash salts as the process proceeds. This liquor is filtered and used for the production of different potassium salts by existing methods.

One of the reasons why less use than might have been expected was made of felspar as a fluxing agent in the past was the fear of glassy, viscous slags, which would be difficult to remove completely from the furnace bottoms. In Sweden, the substitution of electric smelting forestalled this contingency, and it was from this experience that improved methods of manipulating the blast furnace were copied. The removal of the dust by wet-spray, bag-filtration, and electrostatic precipitation, are not so well suited as is a regular scrubbing tower, since the soluble disposition of the material assists separation. Details of recent analytical methods of determining potash appeared in *Ind. Eng. Chem* (*Anal. Ed.*) on October 15, 1943, while particulars of German methods using an acetylene-air mixture and photoelectric cell to give an instant recording of the potash content were ascertained in 1944. On the one hand, the total amount of matte enrichment does not involve a large tonnage as does iron smelting, but the fact that up to twenty times as much potash can be incorporated in the initial charges is a feature worthy of consideration.

Hungary's Chemical Industry

Slow but Successful Recovery

(*from a Special Correspondent*)

SINCE reference was made in THE CHEMICAL AGE of October 12 (*see* p. 450) to the fact that a programme for the production of dyestuffs has recently been put into operation in Hungary, further interesting details about the Hungarian chemical and pharmaceutical industries have been received in this country.

Although the effects of the war, in the final phase of which some very bitter fighting took place in Hungary, are still felt, the chemical industry has staged a slow but successful recovery and its present position is stated to be by no means unfavourable. This is in no small measure due to the elimination, at any rate for the time being, of competition from German chemical firms, as a result of which Hungarian chemical manufacturers hope to be able to take over the markets in the countries of South-Eastern Europe in which Germany held a dominating position before the war.

The recovery achieved so far is illustrated by the fact that in May, 1945, the industry worked with merely 12 per cent of its pre-war productive capacity; at the beginning of the current year, this figure had risen to about 25 per cent, with a subsequent increase to 40 per cent by the end of September. The number of employed has, moreover, already somewhat exceeded the pre-war figure of about 16,000.

As regards the production of industrial chemicals, the well-known Hungaria Chemical Works has maintained its leading position notwithstanding the fact that the Phoenix Works in Nagybánya had to be returned to Roumania. Difficulties in the supply of raw materials and heavy war damage at first handicapped the company's recovery, but remarkable progress has been achieved in the reconstruction of the installations for the production of such important items as copper sulphate, sulphuric acid, hydrochloric acid, and artificial fertilisers, etc. It is hoped that in all these branches of production output will soon reach the pre-war level. The plant for the production of synthetic ammonia of the State Nitrogen Works in Pét was completely destroyed during the war, but the fertiliser plant is in operation, utilising raw materials supplied by Soviet Russia.

The Hungarian pharmaceutical industry has still to cope with manifold difficulties and because all the larger works have suffered war damage through air attacks, as well as loss of machinery and equipment, recovery has progressed less satisfactorily than in the country's heavy chemical industry. Hungary's leading pharmaceutical enterprise, the Chinoin Works, which had an annual turnover of about 25,000,000 Swiss francs before the war, and exported about 60 per cent of its output, has at present a turnover of about 10 per cent of the pre-war figure, while output, on the other hand, is reported to be approximately roughly 50-60 per cent of that of 1938, and large quantities of products are, therefore, manufactured for the replenishment of stocks, both for the home market and for export. It is noteworthy that in the later stages of the war, production of this company increased by about 100 per cent over the pre-war level. Since the end of the war, a number of new pharmaceutical enterprises has been started.

Although the Hungarian chemical industry has still a long way to go before normal conditions are re-established, it is a factor to be reckoned with in post-war Europe.

Oils and Waxes from Coal*

Recent German Work on Catalysts

by Dr. C. C. HALL†

THE Fischer-Tropsch process for the synthesis of hydrocarbons from carbon monoxide and hydrogen, based on a reaction discovered in 1925, was operated in Germany over the period 1939 to 1944 in nine plants, six in the Ruhr area, two in Central Germany, and one in Eastern Germany. The combined rated annual output of these plants was 740,000 tons of total hydrocarbon products, but the maximum output attained was 570,000 tons or rather less than 8 per cent of the total German production of oil (7½ million tons).

The process consisted in preparing a mixture of carbon monoxide and hydrogen in the proportions of 1 to 2 (known as "synthesis gas") which was purified from sulphur compounds and passed over a cobalt catalyst, maintained at a temperature between 180° and 200° C., either at atmospheric pressure or at about 10 atm. pressure (the so-called "medium-pressure" process). The primary hydrocarbon products were separated from the residual gas and divided into fractions for disposal or for conversion into secondary products.

The gasification of hard coke in normal water-gas generators was the main method employed for preparing the synthesis gas, the required ratio of hydrogen to carbon monoxide being obtained either by catalytic conversion to hydrogen of a portion of the water-gas or by adding the hydrogen-rich gas obtained by cracking coke-oven gas in the presence of steam. Two of the plants prepared the synthesis gas by the direct gasification of brown coal. Hydrogen sulphide was removed from the gas by the conventional methods employed in the gas industry, and organic sulphur compounds by passing over alkalised iron oxide at a temperature of 180° to 250° C. The total sulphur content of the gas was reduced by this procedure to about 0.04 grain per 100 cu. ft.

Composition of Catalyst

The synthesis catalyst used in all the plants from 1938 onwards had the composition, in parts by weight: cobalt 100, thorium oxide 5, magnesium oxide 8, kieselguhr 200. It was prepared by precipitation from solutions of the nitrates and reduced in hydrogen for a short period at about 400° C. under carefully controlled conditions. The useful life of the catalyst varied from 3 to 8 months, the cobalt and thorium being recovered from the spent catalyst for use in the preparation of fresh material.

In order to dissipate the heat of the synthesis reaction and to control the temperature within the required range, the catalyst was arranged in narrow spaces between directly or indirectly water-cooled surfaces. For operation at atmospheric pressure, rectangular box-like vessels fitted with horizontal water tubes and vertical steel sheets set about ¼ in. apart were used. For the medium-pressure process the catalyst was placed in the annular spaces between tube plates within a cylindrical shell. The cooling water flowed round the outer tubes and through the inner tubes.

The atmospheric-pressure process was operated in two stages and the medium-pressure process in three stages, the overall space velocity in both cases being about 65 volumes of gas per volume of catalyst space per hour.

Of the nine plants, five operated only at atmospheric pressure, two only at medium pressure and the remaining two used both types of process.

Reaction Products

The reaction products, which were mainly straight-chain paraffins and olefines, were recovered by cooling and adsorption on active carbon. They were fractionated and stabilised by conventional methods. The proportions of the various fractions obtained were as follows:

Per cent by wt.		Atmospheric-Pressure Process	Medium-Pressure Process
C_3 and C_4 hydrocarbons	...	14	10
Fraction, 30—165° C.	...	47	26
" 165—230° C.	...	17	24
" 230—320° C.	...	11	13
Soft Wax, 320—460° C.	...	8	17
Hard Wax, over 460° C.	...	3	10

Irrespective of the pressure used, the most efficient plants obtained yields of 160-165 grammes C_3 and higher hydrocarbons per cubic metre inert-free synthesis gas, i.e., about 80 per cent of the theoretical maximum yield. The highest space-time yield obtained at atmospheric pressure was about 2.2 tons, and at medium pressure 2.4 tons per cu. ft. of reaction space per annum.

The C_3 and C_4 hydrocarbons were liquified by compression and mainly sold as fuel. The fraction 30-165° C. was sold as low-grade petrol for blending purposes, and the 165°-230° C. fraction as high-grade diesel oil for upgrading low-quality tar and petroleum oils. The fraction 230°-320° C. was mainly converted into "Mersol" detergents (used as soap substitutes) by sulpho-chlor-

* From a lecture given to a joint meeting of the Society of Chemical Industry and the Institute of Fuel on November 4.

† Of the Fuel Research Station, D.S.I.R.

ination followed by saponification. A portion of this fraction together with some of the soft wax was cracked to produce olefines, which were polymerised to give good-quality lubricating oils. The bulk of the soft wax was oxidised to produce fatty acids, the main fraction of which was used for soap manufacture, and to a small extent for the production of edible fat. Most of the hard wax was used in the wax industry for polishes, paper impregnation, electrical insulation, etc. Approximately 72 per cent. of the total products was used as liquid fuel and 28 per cent as chemical and special products.

In the most efficient plant only 30 per cent of the total heat input to the process was recovered as primary products, but an additional 25 per cent was recovered as steam and residual gas. The net heat consumed in the production of 1 ton of primary products was equivalent to 4.5 tons of coal (C.V. = 12,600 B.Th.U. per lb.) assuming a thermal efficiency of 90 per cent. for the carbonisation of coal.

On the basis of 10 RM. to the £ sterling, the capital cost of the German plants varied from 450 to 850 RM. per ton annual production, and the operating cost, including capital charges, from 240 to 390 RM. per ton of primary products. The manufacture of the synthesis gas was the major item of cost in the process.

Latest Developments

In the last two years of the war, German research work was largely concerned with developing an iron catalyst which would replace cobalt in the existing plants, due to shortages of cobalt, but the general trend of war-time research in this field was towards the production of olefines, waxes or alcohols for use in the chemical field rather than products for fuel use only. Some advances were made along these lines with cobalt catalysts, but most attention had been paid to iron catalysts, which were found to be most flexible with respect both to operating conditions and nature of products.

Other developments in the synthesis process were the production of iso-butane using mixed-oxide catalysts at 450°C., and 300 atm. pressure, and the synthesis of waxes of very high molecular weight using a ruthenium catalyst at 200°C. and 100 atm. or higher pressure. None of these developments promised much, if any, improvement in efficiency or reduction in the cost of the process.

The most important development arising from the study of product utilisation was the "Oxo" synthesis in which olefines react with carbon monoxide and hydrogen to form aldehydes. Although developed for the production of long-chain alcohols from Fischer-Tropsch olefines this process is of general applicability to compounds containing ethylenic linkages.

Based on the operation of the more efficient German plants, it is estimated that the production of the primary products under present-day British conditions would cost between 2s. and 2s. 6d. per gallon. This is an uneconomic figure based on the realisations obtainable for the products made in Germany. The application of German research work, which would enable a high proportion of the products to be utilised as high-priced chemical products, would materially improve the economic prospects of the process, but for real progress in this direction a reduction in the cost of synthesis gas is the main requirement.

NEW PLASTICS COMPANY

The directors of Thomas De La Rue & Co., Ltd., have announced that negotiations are proceeding for the formation of a new company, to be called National Plastics, Ltd., to acquire and amalgamate the undertakings of De La Rue Plastics, Ltd., and Moulded Products, Ltd. It is intended that Thomas De La Rue & Co., Ltd., shall have a substantial interest in the new company and that the members of the present board of De La Rue Plastics, Ltd., shall join the board of the new company under the chairmanship of Mr. B. C. Westall. Mr. W. J. Merifield, the chairman of Moulded Products, Ltd., will join the board of the new company as deputy chairman. Mr. H. P. Bridge, managing director of De La Rue Plastics, Ltd., and Mr. H. W. F. Ireland, managing director of Moulded Products, Ltd., have agreed to serve as joint managing directors of the new company. A further announcement will be made in due course; in the meantime De La Due Plastics, Ltd., and Moulded Products, Ltd., will continue to carry on their respective businesses as heretofore.

BRISTOL O.C.C.A.

Bristol section of the Oil and Colour Chemists' Association held its second meeting of the new session at the Royal Hotel, Bristol, on October 25, when Mr. H. R. Touchin, B.Sc., gave a paper entitled "Surface Chemistry and Paint Technology." The paper was divided into two parts, the first describing the classical experiments of Langmuir and other workers in respect of surface films, and the second the application of those theoretical methods to the resolution of many paint film problems. In a discussion which followed the monomolecular characteristics of polar materials were debated at some length.

Causes of Fires and Explosions

Lecture to London Chemists

AT a recent meeting of the London Section of the British Association of Chemists, held under the chairmanship of Mr. D. Jackson at Gas Industry House, Grosvenor Place, London, S.W.1, Mr. J. H. F. Smith, M.Sc., F.R.I.C., one of H.M. Inspectors of Factories, gave the first of a series of three lectures, his subject being: "Fire and Explosion: inflammable concentrations and ignition temperatures."

He began by exhibiting two slides showing a small works which had been completly destroyed; 18 people were killed and many more injured. This explosion was not due to war causes, but to a normally harmless material—starch. It was explained that if an explosion occurred which passed along passages and through several rooms, it was almost certainly a dust explosion, caused by the firing of a dust and air mixture. This type of explosion could be caused by starch, gums, sugar, cork dust, aluminium powder, magnesium powder, etc. Other explosions could be caused by organic vapours, petrol, benzene, etc., sprays of organic liquids; gases, such as hydrogen, carbon monoxide, etc.; and even ammonia gas could yield an explosive mixture when mixed with air.

In all cases, there are lower and upper limits of concentration for an explosive mixture to occur. The limits for vapours are accurately known; for dust they are about 0.02 to 0.04 oz. per cu. ft.; for sprays the limits are not really known. For an explosion to occur, there must be a point of ignition and the speeds of the explosive wave can be as low as 50 in./sec. or as high as 3000 metres per sec. The latter value is met with in hydrogen-air explosions and cause a shattering effect; explosions at the low rate may not be so serious if the explosive mixture is not confined.

The Wrong Approach

Whenever an explosion occurs, or its possibility is considered, there is always speculation about the source of ignition. The lecturer emphasised that this is the wrong approach; what should be considered is the prevention of an inflammable concentration.

With bulk solids fire is the most important; dangerous substances are phosphorous and the alkali and alkaline earth metals. Grinding of solids immediately brings about the risk of explosion. In some cases attempts are made to avoid the risk by having sufficient air dilution to cause the concentration to be below the lower explosive concentration. This method is unsatisfactory as local concentration may occur, particularly on starting or stopping a plant. An example was given of an explosion in ducts of a cotton seed plant which had almost completely destroyed a large factory. The use of inert gas is advantageous, but is usually difficult to apply. In practice, ignition should be avoided as much as possible and the employee should be protected. The worst explosions are not those which occur in the plant, but are caused by ignition of the dust in rooms, on rafters, shelves, etc. What usually happens is that a minor explosion occurs in the plant, bursting some portion of the latter. This minor explosion stirs up the dust in the workroom, and a more serious explosion follows. This again disturbs dust in corridors and other workrooms, and explosion passes right through the works. It is essential to remove all the dust by means of vacuum apparatus and care should be taken to avoid dust escaping from a plant; particular care should be taken at feeding points.

Treatment of Liquids

Liquids in containers are not always dangerous, but some may give off explosive vapours. Particles of dangerous liquids such as carbon disulphide may be stored under water, or under inert gas. One system employed consists of pipes containing liquids being enclosed inside a second pipe. The space is filled with inert gas under pressure. If the internal pipe leaks, the gas passes through and causes the liquid to empty into the container. Tanks containing inflammable liquid should be mounded to prevent the spread of the liquid if the tank leaks. The mounding should be sufficient to enable a tankful of liquid to be held. The floors of rooms should be treated in a similar manner, the mounding being carried out at door and drains. Plugs should be provided at drains so that the floors can be washed. Gauge glasses or tanks are a source of danger and self-closing valves should be employed, the valves being open only when a reading is being taken. A particularly safe method of storing liquids is to have a main tank, at or below ground level, connected to a small overhead supply tank. This latter should be fitted with a large emergency outlet valve controlled from a safe distant point.

Liquid spray is not of importance, but may occur in oil fires. The spray from a cellulose spray gun is difficult to ignite. Explosions can occur in the case of oil-fired plant if the oil is sprayed into a hot furnace from an unlighted burner. Drums frequently cause explosions after the liquid is emptied. The safest method of treating these, when they have to be repaired, is to steam them out and then test for organic

vapour. The ignition temperature of a liquid is an important property, but danger can easily arise with liquids or solids with high ignition temperatures, because decomposition during heating yields explosive mixtures. Drums have exploded during welding with oxy-acetylene torches because of this decomposition.

Gas mains can be welded when filled with gas as the concentration is above the upper explosive concentration, but the welding must be carried out in the open air in order to avoid explosive mixtures. With painting drying machinery, explosions are avoided either by dilution of the vapour with air or by burning the organic vapours or both. The exhaust fans must be interlocked so that if the fan fails the oven ceases to work. For many purposes small supboards similar to laboratory fume cupboards are very useful and are employed for the protection of employees sealing. For some processes purging with inert gases is employed, *e.g.*, clearing gasholders previous to repair and an inert mixture is easily obtained by burning coal gas with air.

Employer's Liability In Explosions

Question of Compensation

(by Our Legal Correspondent)

THE liability of an employer to his workers who are injured in an explosion was discussed recently by the House of Lords, when considering the case of Read *v.* Lyons. The worker has, of course, the ordinary right to workmens' compensation; but the question here was whether the worker can recover common law damages, which provide much more adequate compensation.

In this case the employers were managing an ordnance factory for the Ministry of Supply. The worker was doing her work inspecting the filling of shell cases, when an explosion occurred, which injured her. There was no evidence that the employers had been in any way negligent. The worker claimed damages under a rule of law laid down 80 years ago, which has been stated as follows: "The person who, for his own purposes, brings on his lands, and collects and keeps there, anything likely to do mischief if it escapes, must keep it in at his peril; and, if he does not do so, is *prima facie*, answerable for all the damage which is the natural consequence of its escape."

This rule was applied in a case arising out of the 1914-1918 war; injury and damage were caused by an explosion at the Rainham Chemical Works and the owners had to pay damages, as the factory was being used to manufacture picric acid from dinitrophenol and nitrate of soda; the Court found that dinitrophenol and nitrate of soda are dangerous when placed in close proximity. Lord Simon and his legal brethren refused to extend this principle to cover cases of personal injury to workers where no negligence was proved against the employer. It was pointed out by Lord Simon that this rule is applicable only where the dangerous thing escapes from the owner's land and where the owner is using his land for a non-natural purpose. In this case there was no escape; the worker was injured on the employer's premises. "Escape, for the purpose of applying the proposition . . . ." said Lord Simon, "meant escape from a place where the defendant had occupation of, or control over, land to a place which was outside his occupation or control . . It did not mean preventing an explosive substance from exploding, but preventing a thing which might inflict mischief from escaping . . . . In the present case there was no escape of the relevant kind at all and the worker's action failed on that ground."

Lord Simon also expressed some doubt as to the correctness of the opinions expressed in the Rainham Chemical Company's case. Lord Simon indicated that he thought the use of one's land to manufacture munitions for the purpose of helping to defeat the enemy in time of war might be a natural use of the land. It seems, however, pretty clear that Lord Simon was referring only to the manufacture of munitions in war time and that a firm manufacturing explosive substances for ordinary commercial purposes would be using its land in a non-natural way for its own purposes and would still be strictly liable to outsiders if an explosion occurred.

Agreements have been signed in Buenos Aires between the Government of Argentina and ten countries belonging to the International Fuel Emergency Council—Belgium, Canada, Denmark, France, Norway. Poland, Sweden, Switzerland, the United Kingdom, and the U.S.A.—covering the sale of 800,000 tons of Argentine vegetable oils and oilseed cakes. The products involved are 120,000 tons of linseed oil, 60,000 tons of sunflower-seed oil, 15,000 tons of peanut oil, 3000 tons of cotton-seed oil, 2000 tons of rape-seed oil, and 600,000 tons of oil-seed cakes, valued in all at 608 million pesos.

South African Chemical Notes

Sea Contamination by Mustard Gas

(From our Cape Town Correspondent)

OWING to the action of the Soviet Union in buying up all Argentina's supplies of linseed oil, and the trade ban with India, South Africa faces a serious shortage of paint in the next few months. Supplies of linseed oil, a basic ingredient of all paints, are low and the price rose by 2s. 6d. a gal. recently. Although Uruguay manufactures linseed oil, South Africa cannot obtain those supplies because that South American republic is in a United Kingdom purchasing area. Because local manufacturers are finding it increasingly difficult to obtain the necessary pigments from Britain or the United States, white and pastel shades of paint particularly are likely to be scarce in South Africa.

All stocks of poison gas in the Union have now been destroyed. With the destruction by burning in blast furnaces of the last remaining bulk stocks of mustard gas at Firgrove, in the Cape, and Klipfontein, in the Transvaal, and the dismantling of the gas equipment at these two factories, the only mustard gas now anywhere near the Union is the consignment dumped off the Port Elizabeth coast. The chemical warfare plants at Firgrove and Klipfontein, which were constructed during the war by the Union Government for the British Ministry of Supply for the manufacture of poison gas, have been dismantled. The bulk of the stocks of gas was destroyed under the supervision of Dr. W. Bleloch, who was general manager of the chemical warfare factories established by the Union Government under the general munitions agreement. The work took 14 months.

Fishing Grounds Contaminated

The destruction of the gas by burning in blast furnaces was a very hazardous operation, but it was carried out without any casualties, whereas the destruction by dumping in the sea of the canisters of mustard gas undertaken by the Quartermaster-General at the direction of the British Ministry of Supply has led to the contamination of valuable fishing grounds off the Union coast and casualties to fishermen who inadvertently caught a number of the canisters in the nets. No further poison gas will be manufactured in South Africa.

A big new abattoir planned for the Witwatersrand, as a result of recommendations made by the commission which investigated slaughter houses and cold storages throughout the Union in 1944 and 1945, is likely to engage experts from Britain to advise on the making of drugs and medicines from the various glands recovered from slaughtered stock. According to plans already approved by the Department of Agriculture, the Rand abattoir and cold storage installation will be the largest in the country. Designed for an ultimate slaughtering capacity of 120,000 cattle a year, the lay-out provides for the complete utilisation of all the products and special plant will handle offal, horns, hides, tails and even hair, converting these into useful industrial and commercial articles. Being centrally sited, the big new plant will not need to fear seasonal fluctuations in supply of cattle, as it will have a big area to draw on.

The research workers at Onderstepoort, who are making a careful study of the dangers of DDT to human beings and pets, report that, in spite of stories about the poisoning of children, the more they know about the subject the less they fear serious results. Care must be taken, however, they state, that DDT is not swallowed or sprayed on food. The safest form is the dry DDT talc-powder mixture which has been used in such great quantities in clothing and against the skin for the control of human lice and typhus fever.

Oil from a Weed

The possibility of khaki bush, at present regarded as a noxious weed, being cultivated in South Africa as a regular crop, is envisaged by a Pretoria chemist, who has just perfected a method of recovering oils from the weed. He said he had heard that some farmer made a very effective dip from khaki bush by boiling the green weed in water and using the infusion in the cattle dipping tank. Following up this clue, he found that the bush contains an oil which insect pests like ticks and fleas will avoid. By a treatment with benzine, followed by distillation, the oil can be recovered and made into a powerful insecticide. In the course of further experiments he discovered that this oil possesses remarkable frothing properties, and that it is suitable for use as a flotation agent in the recovery of gold, silver, lead, tin and vanadium from complex ores.

At the annual meeting of the National Salt Corporation it was pointed out that this was the first appearance of the salt industry in South Africa as a public company whose function it is to specialise in the salt industry and whose shares are quoted on the Johannesburg Stock Ex-

change. This appearance has been somewhat unheralded, but it, nevertheless, marks the beginning of a development that should lead to remarkable changes in the production of high grade salt in South Africa at competitive prices.

The prospectus of a new company, the National Match Co., Ltd., has been issued. Of the authorised capital of £250,000 in 1,000,000 5s. shares, 600,000 have been issued, 40,000 will be subscribed by existing shareholders at 8s. 6d., and 160,000 are being offered for public subscription at 8s. 6d. per share. The balance will be held in reserve. Apart from its interest in the manufacture of matches the company will subscribe for 406,080 ordinary shares in Masonite (Africa), Ltd., which has been formed to manufacture hardboards and insulation boards.

William Penn Oils, Ltd., has been formed to acquire and exploit in the Union the products of the Canfield Oil Co., of Cleveland, Ohio. The capital is £100,000 in 400,000 5s. shares. Of these 44,700 have been subscribed for by the promoter and original shareholders and 155,300 are to be offered to distributors of lubricating oil and other members of the public at par.

"Adsorption by Charcoal"

North-Western Engineers Meet

THE North-Western branch of the Institution of Chemical Engineers were the hosts at a joint meeting with the Liverpool sections of the Society of Chemical Industry, of the Royal Institute of Chemistry and the Chemical Society at Liverpool on October 26, when a paper, "Some Aspects of Adsorption by Charcoal," was presented by Dr. L. J. Burrage. Col. E. Briggs, vice-chairman of the North-Western branch, occupied the chair, and warmly welcomed the members of the other societies.

Dr. Burrage described the fundamental conditions for adsorption of materials by activated and by unactivated charcoals. Substances containing nitrogen, oxygen or sulphur are adsorbed by unactivated charcoals, the more chemically complex the substance, the less of it is residually adsorbed by a given weight of such a charcoal. A film consisting of a carbon-oxygen complex or compound covers the surface of the particles of a charcoal and plays an important part in adsorption phenomena. The film is displaced by any adsorbed substance.

Charcoals are made by the carbonisation of beech and birch woods, peat, sawdust, and coconut shells, and are activated by steam, air, zinc chloride, or phosphoric acid, the hydrocarbons thereby being removed from the surfaces of the particles. Macro- and micro-pores are formed in the charcoal by carbonisation and by activation respectively. Some experimental work by Dr. Burrage gave evidence that the carbon-oxygen layer on the surface of the charcoal inhibits the adsorption of the vapours of organic substances and that the carbon formed from lignins is the more active portion of the charcoal.

Australian Testing Service

Register of Laboratories

THE Commonwealth and State Governments of Australia have approved the establishment of a National Association of Testing Authorities, a voluntary association of testing laboratories aiming at providing a national testing service to meet the needs of Government, industry and commerce.

The testing facilities of many laboratories established by Government Departments and by other authorities to carry out work for their own purposes have already been made available to the public to varying extents in connection with the measurement and testing of materials, equipment, and manufactured products. The new Association aims at extending this service and ensuring a recognised standard of testing with certificates of test acceptable throughout Australia.

The Association will publish a register of laboratories and the classes of test for which laboratories have been authorised, and it is seeking to secure the recognition of laboratories thus registered, as impartial authorities whose certificates of test will be a guarantee of standard.

According to the *Industrial Australian and Mining Standard,* it is expected that the Association will come into being towards the end of this year. Initially its headquarters will be at the head office of the Council for Scientific and Industrial Research, 314 Albert Street, East Melbourne, C.2.

RADIO-ACTIVE CARBON

The heavy carbon isotope, at. wt. 13, which can be used in research on cancer and other diseases, will be produced in substantial quantities soon, according to the Sun Oil Company and the Houdry Process Corporation. The anticipated production of this heavy carbon is expected to increase from 500 to 1000 times the world supply of this chemical element, while the cost is expected to be reduced to about £10 a gram. Carbon 13 serves as a tracer in chemical reactions in living and non-living materials.

A CHEMIST'S BOOKSHELF

Encyclopædia of Chemical Reactions.

Vol. I. Compiled and edited by C. A. Jacobson. New York: Heinhold Publishing Corporation. pp. 804. $10.00.

To take an example at random, most of us are well aware that aluminium sulphate is hydrolysed by water. With a little persuasion we might even be induced to construct an equation for the reaction which would survive criticism. But if we were further pressed regarding the reaction, few of us would be able to refer to any literature concerning it, other than the standard textbooks. And what would we reply if we were examined regarding, say, the possible reactions between arsenic trichloride and triphenyl arsine, or between barium dithionate and potassium sulphate, or between elemental bismuth and potassium?

No reference work up to the present adequately describes the inorganic reactions about which one may require concise information in a hurry. Dr. Jacobson, many years ago, proposed a book or series of books which would express all such reactions in equation form, giving further information concerning the course of the reaction where necessary, and listing a few of the important literature references. The present volume is an interim stage on the road to the goal which he has set himself.

With the aid of over a hundred abstractors, more than fifteen thousand reactions have already been covered. Those in which the elements aluminium, antimony, arsenic, barium, beryllium, bismuth, and bromine, together with their compounds, are involved, have been arranged in order, and form the first volume of what will undoubtedly be a valuable reference work for inorganic chemists.

That there are numerous gaps in the information, Dr. Jacobson is the first to admit. He felt that it was desirable to proceed with publication, leaving the gaps to be filled by supplements. Each reaction detailed gives the reacting substances, usually a note regarding conditions (which may include other relevant data such as a description of the products of the reaction), an equation or equations representing the course of the reaction, and finally, the literature source from which the abstract has been made. The arrangement is alphabetical as to both reactants and reagents. A comprehensive index of reactants and reagents completes the volume.

The intention of the editor is ultimately to cover the reactions of all the active elements with the exception of carbon and oxygen. Carbon compounds, indeed, are not completely excluded; inorganic compounds such as carbonates and thiocyanates are, of course, dealt with, together with the less complex organic compounds up to hydrocarbons containing six carbon atoms. Organic reagents used essentially for inorganic processes also come under review.

On turning the pages of the Encyclopædia one finds an enormous wealth of information in a clearly presented form. Much of it is standard reference material, but the strong impression arises that a large proportion of it may offer thought for the research worker. The reactions, many and obvious, which are not covered merely lead the reviewer to hope that the editorial board will press on speedily towards the completion of the work—perhaps one should say towards the fulfilling of their mission, since it is clear that such a work can never really be completed.

Dr. Jacobson has commenced a task which should gain him the appreciative thanks of all inorganic chemists. One looks forward with pleasurable anticipation to the appearance of further volumes and, no doubt, supplementary volumes of this indispensable inorganic reference work.

Lanarkshire Scheme

Feared Migration of Coal Miners

A PROPOSAL to erect a coal distillation plant in Lanarkshire was discussed at a conference convened by the Scottish Reconstruction Committee in Glasgow recently. Mr. A. Anderson, M.P. for Motherwell, presided. Representatives of the Scottish Regional Coal Board, the Lanarkshire Trades Council, Lanarkshire M.P.'s, and other interested parties attended.

It was explained that the proposed plant, which may be erected in the Shotts district, will employ only a few hundred people, but it is pointed out that it will create work for many others in subsidiary concerns. The object of the plant is to try to prevent the migration of Lanarkshire coal workers which is anticipated as a result of the gradual working-out of the coal seams in the county, and at the same time to get the fullest value from the coal.

An aluminium yarn, consisting of an aluminium base fibre, sandwiched between two piles of specially formulated plastic film, has been developed by the Dobeckmun Co., of Cleveland, Ohio, in collaboration with the Eastman Kodak Co. and the Aluminium Co., of America. Special process and adhesives make the yarn impervious to tarnish, much lighter than ordinary metallic yarns and easy to handle. The yarn is intended for use in all forms of textiles, combined with wool, rayon, silk, cotton, etc.

Parliamentary Topics

Streptomycin

IN the House of Commons last week, Mrs. Mann asked the Minister of Health whether his attention had been drawn to the claims for streptomycin as a cure for tuberculosis; whether medical science supported the claim; and whether streptomycin was available to patients in our institutions.

Mr. Bevan: I am aware that medical research is being undertaken in the United States of America regarding the value of streptomycin in the treatment of tuberculosis. It would not be justifiable to adopt it for general use in this country until adequate clinical trials have been carried out to test such claims as are made for it, and arrangements to this end are being made.

Subsequently, Dr. Stross asked the Minister of Health how many plants were producing streptomycin; and what was the present estimated production in Britain.

Mr. Bevan replied that he understood from the Minister of Supply that at the moment two plants were producing streptomycin on a very small scale in this country, but none was yet available for clinical trials. Until those trials had been completed it would not be possible to assess the usefulness of the drug.

Linseed Oil

Mr. Belcher, replying to a question by Mr. Bossom, said he was satisfied that the allocation of linseed oil for the manufacture of paint represented a proper division between the paint and other using industries of the linseed oil supplies available to this country. He was aware that the amount available was inadequate to satisfy the demand for paint either in the home or in the export trade.

Scientific Apparatus

The Minister of Education, Miss Wilkinson, replying to questions by Mr. Gibson, said she was aware of the shortage of scientific apparatus in the schools. Steps had been taken, in conjunction with the Ministry of Supply, to ensure that when apparatus suitable for use in schools became available in sufficient quantity, the claims of the schools would receive priority.

Mr. Gibson: Is my right hon. Friend aware that this scientific apparatus is finding its way not into the schools but into retail shops first, and that the schools have to go to these shops and pay extravagant prices for it?

Miss Wilkinson: I hope my hon. Friend will give me particulars of anything of the kind because that is not my information. We have worked very closely with the Ministry of Supply in this matter. There has been difficulty, however, in getting from the schools indents and requests for the kind of apparatus they can use.

Rubber Production

Sir G. Fox asked the Secretary of State for the Colonies on what grounds it had been decided to close down rubber production in East Africa; and how the cost of production in that territory compared with the cost of production in Malaya.

Mr. Creech Jones replied that there was no ban on the production of rubber in East Africa. In view of the greater supplies of rubber becoming available from liberated areas in the Far East, it was no longer necessary to continue the wartime arrangements whereby certain rubber properties were requisitioned and worked on Government account. East African producers were now receiving 1s. 2d. per lb. from South Africa and the Board of Trade had supported that price by offering to purchase at 1s. 2d. f.o.b. all rubber which could be shipped before the end of the year. The cost of production of rubber tended to be considerably higher in East Africa than in Malaya. The recent decline in production in East Africa compared with the rapid increase in Malaya at current prices was a measure of the difference in their respective costs.

Herring Oil Extraction

Scottish Discussions

DISCUSSIONS are now proceeding between the Scottish Home Department, the Ministry of Food, Ministry of Agriculture, and the Herring Industry Board to utilise available plant at Falkirk for the extraction of herring oil during the Clyde and Forth winter herring season.

The Government has already made comprehensive plans for the processing of East Anglian surplus, and it is believed that similar plans will mature for the Scottish season.

The Herring Industry Board has been interested in the development of a herring oil industry in Scotland for some considerable time, but has been handicapped to date by limited bulk of supplies, irregularity, and uncertainty of delivery, high transport charges, and a ready market in other directions. There is every intention to develop this field in due course since herring oil is regarded as a major by-product from the industry.

Meanwhile, fish oil, of varying types, is being used in several important industries to supplement the limited stocks of linseed oil, but with only limited success. In the linoleum industry the use of fish oil has been appreciated and has assisted in maintaining production, but it is available in so limited quantities as to make it uneconomic to alter the chemical plant for the purpose.

OBITUARY

Professor Frankland

Link With Faraday

Professor Percy Faraday Frankland, who was one of the few surviving links with Faraday, died at his home in Argyllshire on October 28 at the age of 88. His research, particularly in optical activity and stereochemistry, resulted in notable contributions to the science of pure chemistry.

Born in 1858, second son of Sir Edward Frankland, F.R.S., he was educated at University College School, the Royal College of Mines, and Würzburg University. In 1880 he returned to the Royal College of Mines as demonstrator and lecturer in chemistry. Eight years later he was appointed professor of chemistry at University College, Dundee; and in 1884 he took up a similar chair at Mason College, later incorporated in Birmingham University, which he held until 1919. Since then he had lived in retirement in Scotland.

Professor Frankland, whose papers to the Royal Society and other scientific bodies numbered over 80, was chiefly concerned with optical activity and stereo-chemistry and his outstanding researches dealt with fermentation and the bacteriology of air, water, and sewage.

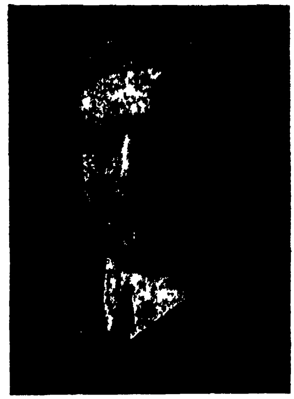
His early research was on the action of certain bacteria on glucose, mannitol, dulcitol, glycerine, and similar compounds. Products such as alcohol, formic, acetic, and succinic acids, carbon dioxide, and hydrogen were determined quantitatively, so far as possible, and a strict bacteriological control was maintained throughout.

Henceforth, while maintaining his interest in biological problems, Professor Frankland's main researches consisted of a study of the optical properties of salts and acyl or other derivatives of optically active acids such as glyceric, tartaric, malic, etc. His presidential address to the Chemical Society for 1912-13 contained valuable summaries of his own and other work in this and similar fields. The school that he founded continued this study, his more distinguished collaborators being Patterson, Pickard, and Price. Pickard, and later Kenyon, directed the flourishing school of stereochemistry associated for so long with Battersea laboratories.

One of the first after Pasteur to study seriously the chemical reactions which occur during the vital processes of numerous lower organisms and to apply such reactions to the preparation of pure products, Professor Frankland was awarded the Davy Medal of the Royal Society in 1919. His own work, considerable as it was, had the further merit of inspiring others to similar study. It was through him that the council of the Institute of Chemistry came to recognise the importance of encouraging chemists to take a greater interest in bacteriology and established the Examination in Biological Chemistry, for which he provided funds and apparatus.

He was president of the Chemical Section of the British Association at its Glasgow

The late Professor Frankland.



meeting in 1901, of the Institute of Chemistry in 1906, and of the Chemical Society in 1911-13. Elected to the Royal Society in 1891, he became a member of the council and was a vice-president in 1917-18. During the 1914-18 war he served on the Admiralty Inventions Board and the Anti-gas and Chemical Warfare Committees, and was chairman of the chemical section of the Royal Society War Committee.

Dr. Joseph John Blackie, Ph.D., Ph.C., F.R.I.C., F.R.S.E., who died suddenly on October 30 at Edinburgh, was technical partner of Duncan, Flockhart & Co., wholesale manufacturing chemists.

Dr. Blackie graduated as Doctor of Philosophy of Edinburgh University in 1935. The subject of his thesis was the alkaloids of the genus senecio, and in the course of his work all the British and many foreign specimens of senecio were examined, and a number of new alkaloids isolated. He was elected a Fellow of the Royal Institute of Chemistry in 1936, and a Fellow of the Royal Society of Edinburgh in 1937.

Since 1925, Dr. Blackie had served for various periods on the Board of Examiners for Scotland of the Pharmaceutical Society, and for a number of years held the position of chairman of the board. He joined the firm of Duncan, Flockhart in 1920, becoming a partner in 1939.

Personal Notes

SIR ALEXANDER FLEMING, of penicillin fame, has become the first Freeman of his native town of Darvel.

SIR ROBERT ROBINSON, president of the Royal Society, has been asked to deliver the Faraday Lecture of the Chemical Society in 1947.

MR. S. L. TURNER, M.A., B.Sc., of A. Gallenkamp, Ltd., was returned as a Conservative candidate in the Oxford City municipal elections on November 1.

DR. F. BELL, F.R.I.C., who has been appointed Professor of Chemistry at Belfast College in succession to Dr. H. Wren, has been principal of Lancaster Technical College since 1941.

DR. F. HARTLEY, formerly secretary of the Therapeutic Research Corporation of Great Britain, Ltd., is now manager of the scientific services department of British Drug Houses, Ltd.

DR. R. F. HUNTER, D.Sc., D.I.C., A.R.C.S., formerly Nizam Professor of Chemistry at Aligarh University, has been appointed research manager to Bakelite, Ltd.

MR. A. R. DUFFIELD, MR. C. L. GUNDY, MR. W. P. SCOTT, MR. R. H. HOMMEL, and MR. R. J. WARD have been appointed additional directors of the National Drug and Chemical Co. of Canada.

DR. BRYNMOR JONES, B.Sc., Ph.D., who been appointed to the Chair of Chemistry at University College, Hull, took his B.Sc. degree with honours in chemistry and his Ph.D. degree at Bangor. He became assistant lecturer in chemistry at Sheffield University in 1931; lecturer in 1934; and senior lecturer in 1939. His researches have been mainly concerned with the kinetics of the halogenation of aromatic compounds.

Low-Grade Chromite Ores

U.S.A. Developing Home Production

ENRICHMENT of chromite concentrates by roasting and leaching has been the subject of investigations by the U.S. Bureau of Mines. The United States, the leading consumer of chromite, depends almost entirely on imports for its supply. Consumption during 1941 amounted to 714,645 tons; domestic chromite production, although the highest since 1918, was 12,731 tons or only 1.78 per cent of the domestic consumption. Home production was accelerated after 1941 by war demands, but only a small proportion of this domestic product was of sufficient quality to be substituted for the high-grade imported chromite demanded for metallurgical purposes.

The principal sources of domestic chromite are California, Oregon, Montana, and Alaska, with small and widely scattered deposits in another dozen States. Without exception, these deposits are low grade, requiring enrichment to produce a commercial product, and do not compete with imported high-grade ores in normal times. For many years the Bureau of Mines has undertaken investigations to develop methods of utilising domestic chromite ores. The problem has been approached from three angles: (1) Mechanical methods of concentration; (2) enrichment by chemical or metallurgical methods; and (3) production of metallic chromium by electrolysis of solutions prepared from ores or concentrates.

The work has shown that chromite concentrates can be roasted in a reducing atmosphere in a rotary kiln so that the iron constituents become more soluble than the chromium constituents in dilute sulphuric acid, leaving an insoluble residue with a Cr : Fe ratio of three or greater. Calcined material with a Cr : Fe ratio of three or greater was produced under the following conditions:

Rotary-kiln dimensions of 3½ ft. inside diameter, 40 ft. long; a maximum kiln hot-zone temperature of 1410° C.; a kiln rotational speed of 0.2 r.p.m.; a carbon : chromite ratio of 0.183 in the feed; coke and concentrates of same mesh; a feed rate of 475 lb. of chromite per hour; cooling in a reducing atmosphere; leaching with 18 per cent sulphuric acid for 6½ hours at 85-90° C.

Further investigations are desirable to determine the most economical and efficient kiln design, carbon : chromite ratio, and leaching method.

German Technical Reports

Latest Publications

SOME of the latest technical reports from the Intelligence Committees in Germany are detailed below. Copies are obtainable from H.M. Stationery Office at the prices stated.

BIOS 643. German anodising practice (3s.).

BIOS 664. *I.G. Farben, Leverkusen*: Salicylic acid, sodium salicylate, synthetic phenol (1s.).

BIOS 669. *Interview with Dr. Roelig, formerly of I.G. Farben, Leverkusen Laboratories*: Hysteresis machine for rubber testing (6d.).

BIOS 686. *I.G. Farben, Zweckel*: Ethylene oxide by direct oxidation of ethylene (6d.).

BIOS 689. *Interrogation of Dr. Casper, Dr. Eisenmann, Mr. Mersh, Dr. Stocklin*: Plastics and rubber (1s.).

BIOS 693. Investigation of the light alloy forging industry in Germany (5s.).

General News——————From Week to Week

Plastic sheeting is to be sold at fixed maximum prices as from January 15.

The Control of Iron and Steel (No. 54) Order, (S.R. & O. No. 1728, 1946), which came into force on October 30, reduced the price of alloy steels containing molybdenum and vanadium.

The strike of 500 workers at Shawfield Chemical Works, Rutherglen, has been settled, and work has been resumed. The men have been on strike for more than four weeks.

More than 100 tons of coal a day will be required by the new Dunlop factory at Speke for processes and heating when full production is reached (*see* THE CHEMICAL AGE, September 21, p. 347).

D.T.D. Specification 678, "Aluminium Alloy-Coated Aluminium Alloy Sheets and Coils" has been issued by the Ministry of Supply. Copies are obtainable from H.M. Stationery Office (1s.).

The Board of Trade announces that up to September 30 2,236 building projects for new factories and extensions to existing factories had been approved. These should eventually provide additional employment for about 190,000 men and 150,000 women.

When a 100-gallon container of battery acid slipped off a lorry on the main road over Shap Fells, last week-end, the acid poured into Borrowdale Beck spawning grounds, killing thousands of salmon, sea trout, trout and eels.

The rubber market will be free to resume normal activities from November 18, Mr. Marquand, Secretary, Overseas Trade, told the House of Commons on Monday. This will permit private trading in rubber and the re-establishment of the London rubber market.

A £15,000,000 scheme for the electrification of line and introduction of Diesel-electric engines is announced by the Southern Railway. The proposal is to electrify a further 284 route miles, eliminating all steam locomotives from the S.R. east of Portsmouth, and to build 200 Diesel-electric engines of 400 to 600 h.p. and 150 powerful electric engines, in addition to multiple unit stock.

Phosphatic and potassic fertilisers, it is understood, will be obtainable by farmers and agriculturists in sufficient quantities to reach the official 1946-47 target, but nitrogenous fertiliser supplies may fall short by as much as 15 per cent. This is the result of international allocation. No potash is now being exported from the British zone of Germany, and Britain must rely on other sources.

Another new industry will be developed on Merseyside as a result of the decision of the Shell Petroleum Co., Ltd., to start production of synthetic soap at the Stanlow Oil Refineries, Ellesmere Port.

The Ministry of Labour and National Service has issued returns showing that in August 425,000 people were employed in metal and chemical industries on manufacture and supplies for the Forces, as compared with 1,070,000 in mid-1939.

Great Britain is exporting 6,000,000 gallons of creosote during the latter half of this year, which will help United States wood preservers, who were otherwise faced with a 20,000,000 gallons shortage owing to coal and steel strikes. Many plants have already had to close down.

The Minister of Food announces that the only change in the existing prices of unrefined oils and fats and technical animal fats allocated to primary wholesalers and large trade users during the four weeks ending November 30, is in regard to sperm oil, all types of which have been increased in price by £14 per ton naked ex store.

Foreign News

A plant for making the intermediates for nylon is being constructed in Texas, U.S.A.

Coal stocks being exhausted, all but one of Berlin's power stations are ceasing operations this week.

Czechoslovakia's leading imports in August included chemical auxiliary materials and chemical products valued at Kcs. 74,743,000.

Exports of nitrate of soda from Chile in the first six months of 1946 totalled 809,250 metric tons, compared with 879,730 tons in the first half last year.

Four factories, one an artificial textile works, have been destroyed by fire in Saxony, in the Soviet zone. German sabotage groups are blamed.

It is reported from Germany that the Berlin police have seized 77,000 phials of cyanide of potassium which were to be disposed of in the black market by drug traffickers.

A rich oilfield, covering 75,000,000 acres, is reported to have been discovered on the slopes of the Andes in Peru. The Peruvian Government proposes spending $80,000,000 in sinking wells.

Shortage of lead and lead chemicals, both imported and domestic, has lead to the U.S. Government issuing a Limitation and Restriction Order for these products, including insecticide productions.

A Dutch whaling factory ship, the first to leave Holland since 1874, is on its way to Cape Town and then to the Antarctic for the opening of the whaling season on December 8.

Austria's magnesite output is increasing steadily. In September, Styria exported 135 tons to Italy, 195 tons to France and 90 tons to Switzerland, while 17 tons were used for home consumption.

As a contribution to the scheme for ensuring a winter supply of coal for German homes in the British and American zones, miners in the Aachen and Cologne districts have undertaken to work on Sundays.

A five years' plan of synthetic oil production, with a yearly output of some 100,000 tons, is reported to have been started by Russia. The oil refineries will be established in Esthonia and in the Southern Sowjetunion.

Nationalisation of I. G. Farben—reported to have been recommended by Social Democrats—is now stated to have been approved by the Drafting Committee of the State Parliament of Great Hesse, in the U.S. zone of Germany.

Swiss chemical exports have, according to official statistics, declined from 40.5 million francs in August to 34.7 million francs in September. Exports of industrial chemicals, on the other hand, rose by 1.1 million francs to 6.9 million francs.

An agreement on trade between Sweden and the British and American zones of Germany has been reached. The two zones, it is understood, need mainly, among other goods, chemicals, especially arsenic, while Sweden's wants include salt, chlorine and diesel engines.

Antimony ore and metal have been brought back under import control in the United States, in order to restrict the importation of ore concenrates or low-grade metal intended for refinement in bond and the re-export of the resultant products to procure enough antimony for needs of U.S.A.

The Siamese Government authorities have informed the Government of the Malayan Union that they are prepared to return British and Australasian tin mines in Siam to their owners. The concerns affected are asked to communicate with the Control of Alien Businesses at Bangkok.

The Carbon Black Company bought the Nash carbon black plant froum the U.S. War Assets Administration for $550,000. The plant, which can produce 15,000,000 lb. annually, is one of six plants built by the U.S. Government to meet the war-time shortage of carbon black for military rubber products.

The Chilean Government has applied to the Export-Import Bank of Washington for a credit of U.S. $20,000,000 to assist the development of oil production and of the copper cement industries.

The pyrethrum industry in Ecuador, started experimentally in 1940, was not seriously developed until 1945, during which year it is understood that 1500 lb. of flowers were shipped to the U.S.A. The 1946 is expected to total 5000 lb., most of which is again likely to be earmarked for the United States.

The 1946 Iron and Steel Exposition was held in Cleveland, Ohio, in connection with the 42nd annual convention of the Association of Iron and Steel Engineers. Manufacturers of steel plant and mill equipment demonstrated new methods and new products and leading technical men in the industry were heard in addresses.

Bolivian exports of tin for the first quarter of 1946 were 9498 long tons, against 9226 in the first quarter of 1945, says *Foreign Commerce Weekly*. Wolfram exports were also lower, but fine copper rose from 1364 to 1659 short tons, and antimony exports amounted to 1746, against 1482 in January-March, 1945.

Russia's requirements of German technicians are now satisfied, according to a statement by Herr Brack, president of the Central Committee for Social Welfare in the Soviet zone. The United States, it is announced, plans to transfer further volunteer Austrian and German scientific and technical specialists to join the 200 already sent to the U.S. since the war ended.

For the first eight months of 1946, Ceylon imported iron and steel to the value of Rs.10,033,493; non-ferrous metals, Rs.2,168,966; chemicals, drugs, dyes and colours, Rs.8,565,184; oils, fats, and resins, Rs.7,604,440; and coal, Rs.13,634,260. During the same period she exported rubber to the value of Rs.145,867,041, and seeds and nuts Rs.35,964,490.

Gammexane is to be produced in Argentina, following an arrangement just completed between Industria Quimica Argentina "Duperial" S.A. and I.C.I. The British company is stated to have put full technical information at the disposal of the concern, which will produce the insecticide at its plant at Sarandi.

Recovery of chemical products from salvaged German ammunition is being successfully continued in the American occupation zone of Germany: smokeless powder is, for instance, being used in manufacturing paint, while fatty acids for soap making are being recovered from metal salt contained in firebomb gelatine, from which gasoline is also being salvaged.

Sweden's pig-iron production amounted to 53,500 tons in August, while the following figures indicate the country's steel production: Bessemer ingots 1300 tons, Thomas ingots 7300 tons, Martin steel 54,700 (both ordinary and high-grade) and 36,100 tons of electric steel. Domestic consumption of iron and steel totalled 98,800 tons.

All Japanese iron and steel production has been concentrated, since July, at the Yawata plant in Fukuoka Prefecture, to eliminate the wasteful consumption of coal in a great number of uneconomically operating plants. This arrangement is to continue until the coal situation improves. The only exceptions are some electric furnaces melting scrap iron.

Recent investigations by the Bureau of Mines in the processing of representative bauxite samples from Saline and Pulaski Counties, Ark., have demonstrated that commercially acceptable concentrates can be obtained from these low-grade materials and a 50-ton demonstration plant has been constructed to continue the investigation on a semi-commercial scale.

An announcement made by the South African Ministry of Commerce and Industries states that the government has decided in the national interest to assume control over the possible establishment of an industry for the manufacture of liquid fuel from coal in South Africa. Legislation is to be introduced during the next session of Parliament to make such manufacture subject to licence.

The tenth edition (1946) of the Classified Directory of the Association of Consulting Chemists and Chemical Engineers, Inc., 50 East, 41st Street, New York, has just been published, and is obtainable on application without charge. The "scope list" contains some distinguished names, well known in this country, such as Marston T. Bogert, J. V. N. Dorr, Wallace P. Cohoe, and G. Ullmann.

New dyestuffs announced in the latest number (No. 52) of the Ciba Review (Ciba, Ltd., Basle, Switzerland) are Coprantine Brown GRLL, for cotton, staple fibre, and rayon; and Coprantine Red BLL, a new bluish red possessing good fastness to light, water and perspiration. Both colours can be used in combination with other Coprantines and are suitable for application on all types of machine.

The U.S. Department of Agriculture announce that estimated world requirements of nitrogen fertilisers exceed supplies by nearly one million tons, or approximately 25 per cent. In the case of phosphate rock and soluble phosphates, demand exceeds supply by 16 per cent. and 32 per cent. respectively. U.S. production of fertilisers is expected to be maintained at the peak war level.

The General Electric Company have taken over from the Du Pont Company government contracts in connection with the atomic energy programme. Their chemical department will operate the government-owned Hanford Engineering Works at Richland, Washington.

Four Government - owned synthetic ammonia plants in the United States are to be restored to operation in order to augment supplies of nitrogen for fertiliser production in the coming year. They are the Cactus Ordnance Works in North-West Texas and those at Morgantown, Ohio River and Missouri.

A solvent extraction system which can increase the annual oil yield from cotton seed, linseed, castor and most oil-bearing seeds, nuts and beans has been developed by the research staff of a Cleveland oil mill. The process is said to extract 98½ per cent. of the available oil from vegetable matter used in the production of soaps, salad oils, cooking oils, linoleum, paints and other products.

A method of prospecting for petroleum and natural gas by bacteriological analysis of subsurface soils has been invented by a Russian geologist. The method was worked out before the war, but further research could not take place until 1945, when an expedition prospected on the basis of this method in the Stavropol region in the North Caucasus and discovered a gas deposit of industrial importance near the village of Mikhailovsky.

In Belgium, a new aluminium rolling mill is being erected in the neighbourhood of Antwerp by the Société Industrielle de l'Aluminium (Sidal), a company with a fully paid-up capital of 52,000,000 francs subscribed, in equal parts, by a French aluminium group and by Belgian financial interests. The manufacturing programme includes a wide range of products such as plates, strips, and tubes.

A list of 513 firms in Poland which are to be nationalised without compensation, and another list of 404 firms for which the Polish Government is prepared to compensate the owners are published in the Board of Trade Journal. British nationals who have interests in any of the firms are urged to communicate with the Trading with Enemy Department, 24 Kingsway, London, W.C.2.

The Dixie Ordnance Works in Louisiana, U.S.A., where during the war anhydrous ammonia was produced from natural gas, has been acquired by Commercial Solvents Corporation, who will resume production as early as possible. Ammonia from the plant is expected to be available for sale by the end of the year; and it will also be a source of raw materials for the manufacture of nitroparaffins and other chemicals.

Egypt will import 300,000 of Chilean nitrate of soda per annum over the next three years, after which the amount may be raised to 800,000 tons per annum for five years. Strikes, however, continue to affect the output of nitrate in Chile.

The U.S. Government and Bolivian mine-owners have signed an agreement for the purchase by the U.S. of tin at a rate of 62½ cents per lb., one cent less than the previous contract which expired on June 30. Under this agreement the U.S. will receive up to 18,000 tons of tin this year, compared with 26,000 tons last year.

Forthcoming Events

November 11. Society of Instrument Technology. College of Technology, Manchester, 7.15 p.m. Mr. A. Jacob: "Handling material in bulk by weight."

November 12. Institution of the Rubber Industry (Midland Section). Goodyear Tyre and Rubber Co., Ltd., Wolverhampton, 7.15 p.m. Mr. F. Siddall: "Rubber machinery developments."

November 12. Institution of the Rubber Industry (Scottish Section). Institution of Engineers and Shipbuilders, Elmbank Crescent, Glasgow, 7 p.m. Mr. G. C. Tullock: "Training within industry."

November 13. The Chemical Society. The University, Liverpool, 5 p.m. Dr. H. W. Thompson: "Some Applications of Infra-red Measurements."

November 13. Institute of Welding (North London Branch). Technical College, Barking Road, East Ham, E.6, 7.30 p.m. Mr. F. Clark: "Repairing and Reclamation."

November 13. Institution of the Rubber Industry (West of England Section). George Hotel, Trowbridge, 7.45 p.m. Mr. W. P. Elliott: "Cost Accounting as a Service to Factory Management."

November 13. Oil and Colour Chemists' Association (London Section). Royal Society of Tropical Medicine and Hygiene, 26, Portland Place, London, W.1, 6.30 p.m. Mr. N. A. Bennett, Mr. R. M. W. W. Wilson, Dr. F. Wormwell: "Anti-corrosive pigments."

November 13 and 14. Iron and Steel Institute. Institution of Civil Engineers, Great George Street, London, S.W.1. Autumn meeting. Morning sessions, 9.30 a.m.-12.30 p.m.; afternoon sessions, 2.30 p.m.-5.30 p.m.

November 14. Royal Institute of Chemistry (Birmingham and Midlands Branch). The University, Birmingham, 7 p.m. Mr. F. Challenger: "Recent Investigations in the Organic and Biological Chemistry of Sulphur."

November 15. The Chemical Society. The University, Glasgow, 7.15 p.m. Professor A. R. Ubbelohde: "Melting and Other Phase Changes."

November 15. Society of Instrument Technology (Scottish Section). Royal Technical College, Glasgow, 7 p.m. Mr. S. H. Hawkins: "Temperature Measurement."

November 15. Royal Institute of Chemistry. Geological Society's Rooms, Burlington House, Piccadilly, London, S.W.1, 6 p.m. Dr. J. C. Withers: "The Chemist as Information Officer" (Streatfeild Memorial Lecture).

November 15. Society of Dyers and Colourists (jointly with R.I.C., Chemical Society, S.C.I. and Textile Institute). College of Technology, Manchester, 6.30 p.m. Professor E. L. Hirst and Dr. J. K. N. Jones: "The Chemistry of Plant Gums and Related Substances."

November 18. Society of Chemical Industry (London Section, jointly with Food Group). Royal Institution, Albemarle Street, London, W.1, 6.30 p.m. Mr. F. P. Dunn: "British Chemical Publications" (Jubilee Memorial Lecture).

November 19. Hull Chemical and Engineering Society. Church Institute, Albion Street, Hull, 7.30 p.m. Dr. L. Mullins: "X-rays in Industry."

November 20. Society of Dyers and Colourists (Midlands Section). Midland Hotel, Derby, 7 p.m. Mr. C. C. Wilcock: "Preparing, Dyeing and Finishing of the New Fibres."

November 20. The Chemical Society (jointly with Dublin Section of R.I.C.). University College, Upper Merrion Street, Dublin, 7.30 p.m. Dr. T. G. Brady: "Biochemical Microtechnique."

November 20. Institution of the Rubber Industry (Leicester Section). College of Art and Technology, Leicester, 7.30 p.m. Mr. F. S. Roberts: "Rubber Compounding Ingredients."

Company News

British Celanese, Ltd., report consolidated net profit of £1,781,144 for the year ended June 29 last. The ordinary dividend remains at 8 per cent.

The nominal capital of **Glovers (Chemicals) Ltd.**, Wortley Low Mills, Lower Wortley, has been increased beyond the registered capital of £7000 by £23,000 in £1 shares.

Anglo-Iranian Oil Co., Ltd., is paying an interim ordinary dividend of 5 per cent, which is the same as for the previous four years.

An increased interim dividend—10 per cent as compared with 7½ per cent—is being paid

by **United Molasses Co., Ltd.** This is the first change since 1938.

Trading profit of **Erinoid, Ltd.**, for the year ended July 31 was £133,020, compared with £59,755 for the previous year, and net profit was £22,257 (£17,611). The ordinary dividend is unchanged at 10 per cent.

A trading loss of £14,378 is reported by **Triplex Safety Glass Co., Ltd.**, for the year ended June 30. Last year there was a profit of £117,355. The net loss is given as £26,847. The dividend of 7½ per cent is half that paid last year.

Trading profit earned by **Thomas W. Ward, Ltd.**, for the year ended June 30 totalled £399,501. To the final ordinary dividend of 6¼ per cent is added a victory bonus of 2½ per cent, making 12½ per cent for the year, compared with 10 per cent and no bonus last year.

Lever Brothers and Unilever, Ltd., are paying an unchanged ordinary dividend of 5 per cent for 1945. Consolidated net profit, excluding the proportion attributable to outside shareholders' interests in subsidiary companies, is given as £8,639,008, which compares with £8,562,171 for 1944, and the company's net profit before appropriations £7,118,672 (£6,682,216).

Lever Brothers & Unilever N.V., will pay a corresponding dividend, calculated in accordance with the equalisation agreement and converted at the rate of exchange of Fl.10.691 to £1 sterling, of 4.45 per cent (actual Fl.44.50 per share of Fl.1000) less 15 per cent dividend tax payable on presentation of the appropriate dividend coupon. Consolidated net profit, excluding the proportion attributable to outside shareholders' interests in subsidiary companies, was Fl. 18,079,358. The net profit before appropriations was Fl.15,453,551. No comparative figures are given for N.V. for 1944 as they included a large amount of profit attributable to 1940-43. The figures for the year 1945 include several exceptional items.

New Companies Registered

Speedoil (Great Britain) Ltd. (422,269).—Private company. Capital £500 in £1 shares. Chemists, druggists, oil refiners, etc. Subscribers: H. Gordon; A. J. Russell. Registered office: 20, Chandos Avenue, Whetstone, N.20.

Deleopold Products Ltd. (422,443).—Private company. Capital £1000 in £1 shares. Manufacturers of and dealers in chemicals, etc. Directors: L. de Leopold; A. W. Metcalfe. Registered office: 34, Sherrards Park Road, Welwyn Garden City.

Rigby Chemicals, Ltd. (422,357).—Private company. Capital £1000 in £1 shares. Manufacturers, importers and exporters of and dealers in chemicals, gases, etc. Subscribers: P. M. Cordell; V. E. Winter. Secretary: V. Winter, 89, Kingsway, London, W.C.2.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BRITISH GENERAL MANUFACTURING CO. (1941) LTD., London, W.C., chemical, etc., manufacturers. (M., 9/11/46.) October 8, mortgage, to Midland Bank, Ltd., securing all moneys due or to become due to the Bank; charged on 40, Glasshill Street, Southwark, with machinery, fixtures, etc. *Nil. December 14, 1945.

UNITED KINGDOM GAS CORPORATION, LTD., London, E.C. (M., 9/11/46.) October 12, Trust Deed dated October 1, 1946, securing £2,200,000 with a premium of £2 per cent payable on redemption (inclusive of £1,200,000 like stock secured by Trust Deeds dated November 14, 1935, etc.), present issue £1,000,000; general charge. *£1,500,000. July 16, 1946.

Satisfaction

F. COLLINS, LTD., Manchester, chemical and general merchants. (M.S., 9/11/45.) Satisfaction October 14, £1000, registered October 2, 1942.

Chemical and Allied Stocks and Shares

LED by a further general advance in British Funds, investment buying has continued to dominate stock markets, with the main emphasis on securities offering higher yields than gilt-edged. Home railway prior charges were again prominent, also bank and insurance shares, while the scarcity of industrial debentures and preference shares, which are held very firmly, was partly responsible for the increased demand again in evidence for leading ordinary or equity shares. The latter were also helped by the good impression created by recent dividend announcements.

Shares of chemical and kindred companies participated in the upward market trend and were also helped by news of expanding chemical exports. Imperial Chemical at 44s. again moved higher, B. Laporte rose

further to 95s. 7½d. Fisons were 57s. 3d., and British Drug Houses 59s. Greeff-Chemicals Holdings 5s. shares changed hands at 12s. 6d. Turner & Newall (87s. 3d.) continued to be helped by higher dividend hopes, while United Molasses were good at 55s. 9d. xd on the unexpected increase in the interim dividend. Borax Consolidated deferred (47s. 9d.) remained under the influence of current dividend estimates. Talk of a higher interim payment next month was partly responsible for an advance to 138s. in the units of the Distillers Co. De La Rue at 13⅜ responded to the latest developments in connection with the plastics interests of the group, and were also favoured in view of the forthcoming interim dividend and the splitting of the £1 shares into four of 5s. each. British Oxygen 98s. 9d., Associated Cement 69s. 4½d., and British Plaster Board 33s. 3d. also reflected the upward market trend. British Aluminium 43s. 9d., and Birmid Industries 97s. continued to be helped by indications of increasing uses of aluminium and aluminium alloys.

Powell Duffryn at 26s. 1½d. moved higher on the good impression created by the consolidated accounts, but colliery shares generally encountered a little profit-taking following their recent good gains. Stavely were 57s., Shipley 42s. 6d., and Bolsover 67s. 3d. Steels recorded moderate gains, with Dorman Long 26s. 7½d., Guest Keen 43s. 9d., and Stewarts & Lloyds 52s. 4½d. Babcock & Wilcox, which remained under the influence of the higher dividend, rose further to 67s., and Hopkinsons responded to higher dividend possibilities. Textiles moved moderately higher; Lancashire Cotton Corporation were good at 40s. 6d. on current dividend estimates. Courtaulds moved up to 53s. 9d., and British Celanese were 35s. 3d. following publication of the full results. Lever & Unilever reflected disappointment with the unchanged 5 per cent dividend and at one time fell back to 45s., but later recovered to 49s. 6d. a decline of only 6d. on balance for the week. The market is continuing to assume that in due course the Lever group will feel disposed to follow a less conservative dividend policy and that the 10 per cent payments of pre-war years are likely to be regained.

Boots Drug were firm at 60s. 6d., Aspro shares rose to 41s. 9d., Beechams deferred were 27s. 3d., Sangers moved up to 34s. 3d., and Timothy Whites to 45s. 9d. British Glues & Chemicals 4s. ordinary have been favoured at the higher level of 16s. 4½d. Triplex Glass rallied to 38s. on the good financial position shown by the accounts and the directors' reference to overwhelming demand for the company's products. The greater part of the difficulties which resulted in the slump in earnings and halving of the dividend for the past year is attributed not to safety glass, but to endeavours to build up an ancillary business in manipulation and sale of articles made of "Perspex"; energetic steps have been taken to rectify the troubles encountered. Oil shares failed to hold earlier gains.

British Chemical Prices

Market Reports

REPORTS from nearly all sections of the London general chemical market indicate a steady demand with available supplies inadequate to meet immediate requirements. Delivery specifications under existing contracts cover good quantities and new bookings for future delivery continue on a fair scale. The market is without feature, with a routine trade passing in the soda products and potash products. A steady flow of inquiry for pitch has been maintained in the coal tar products market. Elsewhere, conditions continue firm, with production proceeding along satisfactory lines.

MANCHESTER.—Alkali products generally are meeting with a good demand on the Manchester chemical market and home users' inquiries for these have been circulating freely during the past week. Shippers are also interested in these as well as in a fairly wide range of other products. Delivery specifications for domestic users of the ammonia and magnesia products cover good quantities, and there is likewise a steady demand for the potash chemicals as they become available and for the mineral and other acids. Firm price conditions continue throughout the market. So far as new bookings are concerned, moderate activity has been reported locally in the tar products section, but existing orders in most sections are being steadily drawn against.

GLASGOW.—The usual amount of business was transacted in the Scottish chemical market during the past week. There has been no slacking off in demand for all classes of industrial chemicals and raw materials, and the difficulty continues to be the inability of suppliers to make delivery against such heavy demands. Prices show an increasing tendency to rise. In the export market the supply position is deteriorating and an increasing number of raw materials are becoming in exceedingly short supply, rendering as a consequence the export of certain manufactured chemicals nearly impossible. The past week, however, has seen a considerable volume of business transacted in such chemicals as precipitated chalk, zinc oxide off-colour grades, plasticisers, sulphur, aluminium sulphate, zinc chloride, fluorspar, and sulphuric acid. Delivery of such chemicals, however, takes increasingly longer and shipping space is difficult to arrange. Prices in this market also show no tendency to decrease.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Molten salt baths.—Ajax Electric Co., Inc. 29251.

Metal deposition.—P. Alexander. 29280.

Liquid separating apparatus.—W. Alexander. 29622.

Stainless steel.—Alloy Research Corporation. 29333-4.

Aryloxymonocarboxylic acids.—American Chemical Paint Co. 29252.

Separating materials.—American Zinc, Lead, & Smelting Co., and C. E. Wuensch. 29264.

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Temperature regulating.—Bailey Meters & Controls, Ltd., and C. W. Payn. 29625.

Polystyrene resins.—British Resin Products, Ltd., E. M. Evans, and J. F. Williams. 29755.

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Storage of liquefied gas, etc.—N. D Chopra. 29229.

Treatment of cast iron.—Chromium Mining & Smelting Corporation, Ltd. 29906.

Separation of pulverulent materials.—Cie. de Produits Chimiques et Electrométallurgiques Alais, Froges & Camargue. 29867.

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Water-repellent compositions.—Soc des Usines Chimiques Rhône-Poulenc. 29699.

Complete Specifications Open to Public Inspection

Production of hot gases under pressure.—Brown, Boveri & Cie A.G. April 5, 1945. 115/46.

Cyanidation of copper-bearing gold ores. —American Cyanamid Co. April 7, 1945 35098/45.

Plasticised elastomer compositions.—American Cyanamid Co. April 4, 1945. 7656/46.

Fluid flow control devices.—Dole Valve Co. April 6, 1945. 10000/46.

Vacuum distillation process and apparatus.—Distillation Products, Inc. April 5, 1945. 8724/46.

Organic amino compounds.—E.I. Du Pont de Nemours & Co. April 3, 1945. 10287/46.

Manufacture of fibre-forming synthetic linear polyamides. April 3, 1945. 10288/46.

Automatic operation of ovens for electrolysing in the melt.—L. Ferrand. June 30, 1942. 25924/46.

Plasticised vinyl resin compositions —B. F. Goodrich Co. April 5, 1945. 7553/46.

Pesticides.—B. F. Goodrich Co. April 2, 1945. 8550/46.

Manufacture of substituted furoimidazoles.—K. Hoffmann. April 4, 1945. 9152/46.

Salt bath furnaces.—A. de F. Holden. April 5, 1945. 28869/45.

Polymerisation of methacrylic acid esters. —I.C.I., Ltd. Sept. 18, 1941. 13191/42.

Polymerisation of vinyl esters of organic acids.—I.C.I., Ltd. Sept. 18, 1941. 13192/42.

Processes for the chemical conversion of organic substances.—Laboratoire de Recherches Industrielles (Michot-Dupont.) March 20, 1942. 25881/46.

Distilling process and apparatus.—J. L. et. Lavigne. April 4, 1945. 10437/46.

Preparation of alkyl esters of α(2-4-carboxy)-thiazolidinyl phenaceturic acid and derivatives thereof.—Lederle Laboratories, Inc. April 4, 1945. 7115/46.

Distillation apparatus.—A. D. Little, Inc. April 3, 45. 24902/46.

Treating a gas with liquid.—Pease Anthony Equipment Co. April 6, 1945. 10006/46.

Manufacturing hollow glass objects.—Pyrex S.A. May 11, 1943. 25888/46.

Process for treating cellulosic raw material in order to obtain products and byproducts.—J. C. Séailles. Feb. 4, 1941. 25874/46.

Manufacturing and extracting calcium aluminates.—J. C. Séailles. April 23, 1943. 25876/46.

Process for making phosphorous products and soluble calcium aluminates out of phosphorous ores.—J. C. Séailles. March 6, 1941. 25878/46.

Manufactures of calcium aluminates.—J. C. Séailles. March 24, 1944. 26046/46.

Process for treating cellulosic raw materials.—J. C. Séailles, and Soc. des Ciments Français. Dec. 11, 1942. 26052/46.

Catalytic processes and catalyst preparation.—Shell Development Co. April 2, 1945. 2764/46.

Shaping solid objects of glass and like materials.—S.A. des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny & Cirey. March 27, 1945. 25884/46.

Dissolution of aluminates of lime with a view to production of pure alumina.—Soc. des Ciments Français. May 6, 1942. 25879/46.

Extraction of alumina from raw calcium aluminates.—Soc. des Ciments Français. May 6, 1942. 26053/46.

Double-action distillation.—Soc. des Etablissements Barbet. May 17, 1943. 25862/46.

Double-action distillation.—Soc. des Etablissements Barbet. Oct. 6, 1944. 26020/46.

Manufacturing solid solutions of metallic carbides and corresponding compositions.—Soc. le Carbone-Lorraine. July 16, 1941. 25926/46.

Producing carbides of tungsten or of molybdenum and their sintered alloys.—Soc. le Carbone-Lorraine. Aug. 4, 1941. 25927/46.

Antibiotics.—E. R. Squibb & Sons. Apr. 5, 1945. 10144/46.

Process for treating acid sludge.—Stauffer Chemical Co. April 3, 1945. 24002/45.

Disazo dye.—Technicolor Motion Picture Corporation. April 7, 1945. 31836/45.

Complete Specifications Accepted

Oil or like filter elements.—AC-Sphinx Sparking Plug Co., Ltd., and D. B. Browne. Sept. 22, 1944. 581,105.

Monalkamine esters substituted pyrrole-3-carboxylic acids.—American Cyanamid Co. July 31, 1943. 581,152.

Process for the preparation of alkylation derivatives of dihydroxydibenzanthrone.—E. G. Beckett, and I.C.I., Ltd. Aug. 15, 1944. 581,259.

Production of organic esters of cellulose. —British Celanese, Ltd. March 9, 1944. 581,157.

Curing of polymeric materials.—J. M. Buist, D. A. Harper, W. F. Smith, G. N. Welding, and I.C.I., Ltd. Dec. 21, 1942. 581,143.

Regeneration of vulcanised natural and synthetic rubbers.—R. B. F. E. Clarke, and I.C.I., Ltd. June 24, 1942. 581,136.

Curing of polymeric materials.—D. H. Coffey, W. F. Smith, H. G. White, and I.C.I., Ltd. June 25, 1943. 581,146.

Heat exchange devices.—J. L. Coltman, and I.C.I., Ltd. March 31, 1944. 581,188

Gas measuring apparatus.—Compañia para la Fabricacion de Contadores y Material Industrial S.A., and P. Viteau. July 10, 1944. 581,248.

Preparation of unsaturated oxalates and polymers thereof.—J. W. C. Crawford, F. J. H. Mackereth, and I.C.I., Ltd. July 26, 1944. 581,251.

Water-soluble resinous condensation products.—Distillers Co., Ltd., J. D. Morgan, and B. Frenkel. Jan. 21, 1942. (Cognate applications 905/42 and 1073/43.) 581,127.

Production of amino-hydrazines.—J. G. N. Drewitt, and D. P. Young. June 28, 1944. 581,153.

Plasticisation of synthetic rubber-like materials.—Dunlop Rubber Co., Ltd., and

P. H. Amphlett. Nov. 17, 1942. 581,141.

Production of hydrocyanic acid and catalysts therefor.—E.I. Du Pont de Nemours & Co. Sept. 20, 1943. 581,271.

Production of haloacetyl halides.—E.I. Du Pont de Nemours & Co. April 7, 1944. 581,278.

Methods of and apparatus for the combustion of gaseous fuel.—H. J. C. Forrester. (Selas Corporation of America.) July 13, 1944. 581,091.

Curing of polymeric organic materials.—W. Furness, L. E. Perrins, W. F. Smith, and I.C.I., Ltd. Feb. 10, 1943. 581,144.

Production of agglomerates of carbonaceous material.—Gas Light & Coke Co., N. E. Siderfin, R. S. Chaplin, H. W. Cartwright, and C. H. Lewis. May 8, 1942. (Addition to 577,792.) 581,133.

Manufacture of basic esters and amides of α-substituted aryloxy acetic acids.—J. R. Geigy A.G. July 30, 1943. 581,230.

Production of aryl derivatives of trichlorethane. Geigy Co., Ltd., I. E. Balaban, and R. D. Calvert. Oct. 5, 1944. 581,156.

Method for adhesively uniting materials or articles.—D. A. Harper, and I.C.I., Ltd. May 29, 1942. 581,134.

Preservation of rubber and the like.—I.C.I., Ltd. July 30, 1943. 581,099.

Production of organic fluorine compounds.—I.C.I., Ltd. Aug. 11, 1943. 581,254.

Chemical immersion heaters.—I.C.I., Ltd., and W. A. Caldwell. March 24, 1942. 581,129.

Vulcanisable compositions and methods of making the same.—H. W. K. Jennings. (Wilmington Chemical Corporation.) June 15, 1944. 581,089.

Synthetic resins.—Kodak, Ltd. (Eastman Kodak, Co.) Aug. 11, 1944. 581,255.

Apparatus for producing fire extinguishing foam.—National Foam System, Inc. March 12, 1943. 581,206.

Bonding cured olefin-polysulphides and related sulphur-containing plastics.—W. J. S. Naunton, W. E. Roberts, J. T. Watts, and I.C.I., Ltd. Sept. 2, 1942. 581,137.

Process for the manufacture of alkyl sulphates.—Nicholas Proprietary, Ltd. Dec. 13, 1943. 581,115.

Copolymers.—Pittsburgh Plate Glass Co., and F. J. Cleveland. (Pittsburgh Plate Glass Co.) April 1, 1942. 581,170.

Liquid control apparatus.—C. A. Pugh, D. G. Booth, and Plessey Co., Ltd. (Cognate applications.) Nov. 12, 1942. Addition to 577,311.) 581,140.

Process for dyeing or colouring cellulose esters or cellulose ethers.—Soc. of Chemical Industry in Baslo. Oct. 15, 1941. (Cognate applications 14333/42 and 14334/42.) 581,139.

Process for the production of ethyl benzene.—Standard Oil Development Co. July 30, 1942. 581,145.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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GLASGOW: 116 Hope Street (Central 3970) — BIRMINGHAM: Daimler House, Paradise Street (Midland 0784-5)

THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1429. — November 16, 1946 — Annual Subscription 21s. Overseas 26s.

Equipment for Chemical Industries

THE need for increasing production has been emphasised during the past weeks by Government spokesmen and by leaders of industry. In our article "Industrial Policy," a fortnight ago, some aspects of the problem were discussed, and previously we pointed to the *damnosa hereditas* left us by the late unlamented war in the shape of controls of every kind. Some measure of control there must be just now over raw materials and production. It would be foolish to expend a large labour force upon luxuries or frivolities while leaving essential work undone. With control, however, there is the responsibility for good planning. There is the responsibility for instituting sound long-term policies. Is there not to-day too much hand-to-mouth opportunism about our industrial policy?

Industrial planning is the responsibility of many Ministries. They may work in harmony, or they may not. Even if they do so, there is always scope for mistakes which can immediately be seen to be ludicrous when they are pointed out, but which do not always come to light. The Civil Service is not to blame; inconsistencies are almost inevitable over so wide a field as the whole range of British industry: the only real cure is the provision of ample supplies of goods and labour—or manufacturing capacity, which is not quite the same thing—and freedom from control. Freedom from control cannot be achieved, however, until supplies are ample. An example of the sort of difficulties we have in mind was recently provided by Mr. E. J. Erroll, M.P., in regard to printing machinery. A firm in his constituency is producing printing machinery for export, while another that is making grinding wheels—essential equipment in engineering workshops—receives no priority in labour or material because its products are for the home market only. Modern printing machinery cannot be made without grinding wheels, however, and thus the manufacture of the printing machinery for export is being held up. Mr. Erroll added: "In the same district, machine tools are being made for direct export which are urgently needed by firms elsewhere making more valuable machinery also intended for export, but which, too, is desperately needed in England."

This opens for discussion a subject upon which we had something to say while the war was still on, namely: Is it desirable to equip foreign manufacturers before we equip our own factories? It is always better to illustrate an argument in terms of

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common experience, and for this purpose we shall take colliery equipment. Let us suppose that upon taking over the mines, the National Coal Board should find itself able to instal immediately a large number of underground loading machines and conveyors. This measure would assist materially to solve manpower difficulties at the coal face and would considerably ameliorate the hard work performed there. It would increase production of coal. Would the Government maintain that the right thing to do was to forbid the manufacture of loading machines and conveyors for supply to British collieries until all foreign export orders that we could obtain had been fulfilled? To supply the home market first would enable coal to be obtained in quantities sufficient to keep our industries going without fear of breakdown, and might allow also of the export of coal. To supply the foreign market would gain immediate foreign currency. The one policy is hand-to-mouth opportunism; the other is sound long-term planning. The present Government policy seems to be to grasp the immediate short-term advantage and to let the long-term policy go hang. If that is so, it is basically unsound.

Is the provision of chemical plant developing on sound lines? There are conflicting views and there is conflicting evidence. We hear of manufacturers complaining that they cannot get British chemical plant in reasonable quantity or with a reasonable time of delivery, while foreign competitors are being supplied at the highest priority. It is pointed out that in this way while we may be gaining a little export trade in chemical plant, we are losing our long-term market for chemicals which can be made cheaper and possibly of better quality in the newer plant supplied abroad. We are throwing away our birthright for a mess of potage.

The contrary view might be that this is an opportunity which can never return of transferring to Britain the foreign trade in chemical plant that was so prominent a feature of German industry before the war. The world is crying out for chemical plant; America can supply some, but by no means all. Britain, it is said, can seize this market, if our manufacturers are given the opportunity. We have the skill, but it is doubtful whether we have the facilities to do so. Steel is in short supply and must be rationed according to priorities governed by the policy of those in control. The labour force is insufficient until we can instal the machines necessary for an increase in production per man-hour; but the machines that we need for this purpose are being sent abroad. Worst of all, perhaps, the supply of chemical engineers is insufficient and without these we cannot hope to undertake sufficient world trade to capture the markets held previously by Germany. The question is asked whether the British chemical plant manufacturer has the power to undertake any considerable foreign business at the moment, and whether he should not concentrate on supplying the home chemical industry with the plant it requires.

The answer to this question may well be that unlike most industries which depend on a sound home market for their stability in the export market, it could be argued that the home market for chemical plant in normal times is not sufficient to keep a really good chemical plant industry in being. The export market may well be the more important and it may well be that by reason of the skill and experience gained abroad the British chemical plant manufacturers can properly cater for the home market, and can only do so adequately if there is a large volume of foreign trade.

This appears to us to be a problem that cannot easily be solved, and that must be the subject of a long-term policy. What is the long-term policy of chemical manufacturers towards the export of chemical plant? Why should not chemical manufacturers assist plant manufacturers with advice in a joint effort to secure foreign markets, while safeguarding the British position as regards chemical manufacture? We ask this question because it appears from such information as we have that that was the German practice. Nothing but good can come from such collaboration. Nothing but good can come from Britain taking her rightful place as a great chemical plant-manufacturing centre for the world. That is the type of export which this country should encourage for it is based on skill in design and manufacture of a very high order. If buyers cannot get what they want in this country, they will go elsewhere and we shall have lost them—permanently. But we suggest that before our goods are placed on offer those who now exercise controls should decide what should be the long-term policy regarding priorities for chemical plant.

NOTES AND COMMENTS

The Uranium Rush

NEWS of the reported agreement between the American and Belgian Governments for the cession of the whole output of uranium from the Belgian Congo to the United States reveals that the frantic world-wide search for this valuable metal is still in progress. Other reports indicate that many nations are going " all out " in their efforts to find uranium, either in their own countries or else in a country with similar political outlook. One report indicates that the U.S. Navy is to send a gigantic expedition into the Antarctic to hunt for the rare metal. Five thousand men and many ships are to take part in this treasure hunt. What the Russians are doing in this respect is not known, but it can be taken for granted that they, too, are in the forefront of this "uranium rush" which, as one scientist said over twelve months ago, will make the oil rush look like a costermonger's Derby. Britain, too, is not behind in the search for uranium. She is probably in a better position than America in this respect, because the mine in Canada from which most of the world's uranium is now obtained is in the King's name. But expeditions have been sent in the past few years to, among other places, the Falkland Islands, and it can be assumed with reasonable certainty that geologists are included in the personnel. It is a strange irony that a substance unknown to the man-in-the-street up to two years ago should now be the subject of much heart-burning on the part of scientists, and much exploration work on the part of governments. It is estimated that known sources of uranium if used for power purposes, are only sufficient for about 200 years. So, in addition to giving security to governments not at present in possession of uranium mines, new sources will have to be found if only to make sure of power supplies for the future.

Guarding Dangerous Machinery

THE Factories Acts lay upon the employer a very stringent duty with regard to the protection of dangerous machinery. The extent of this duty was emphasised by a recent decision of the Court of Appeal. The Court went so far as to say that where there is a definite breach of a safety provision imposed by statute on the occupier of a factory, and a workman is injured in a way that could result from that breach, the onus of proof shifts on to the occupier to show that the breach was not the cause of the injury. In the ordinary way, the worker who claims that he was injured through a breach of the Factories Acts, has to prove the statutory offence and then prove that he was injured as a result of the statutory offence. In this case the employers also pleaded that they had delegated their duty of protecting the machine to the workman who was injured. The Court rejected this plea, too. Such a plea will not succeed, apparently, unless the employer proves clearly that the workman to whom he has delegated the duty is fully apprised of the nature and extent of the duty and is competent to discharge it. Lord Justice Scott remarked : " The truth is, we expect, that the defendants did not take the trouble to ascertain what kind of guard was required by the statutory rules, or did not care whether they were being broken. If so, it would be absurd to draw an inference that their responsibility has been shifted by delegation on to the shoulders of the workman."

Shy Scientists

WE Britons generally have always been disposed to practice self-depreciation until it becomes a fault, but in no section of the community is there a greater tendency to hide shining lights beneath the proverbial bushel than among scientists. Not once, but often, has it happened that we have left it to another nation to proclaim with much blowing of their own trumpets some outstanding new development for which they claim all the glory, when in fact our own scientists have themselves made the same discovery and brought it to the same stage of practicability—possibly long before the other nation had even dreamed of it. Then, belatedly, we come out with a rather apologetic claim of our own, as though to say : " Well, we knew about it all the time, but didn't like to mention it."

Mechanical Calculator

SUCH is the case following the publicity recently given to the electronic calculating machine developed at Pennsylvania University, to which we referred in these columns last week, for it has since been

revealed that an automatic calculating machine capable of multiplying two 10-figure numbers in two-thousandths of a second has been planned by the Mathematics Division of our own National Physical Laboratory. Costing between £100,000 and £125,000, it will take two or three years to complete. The machine is called the A.C.E.—automatic computing engine—and is, in fact, claimed to work at possibly a higher speed than Pennsylvania's E.N.I.A.C.—Electronic numerical integrator and computer. Heading the team working on the A.C.E. are Sir Charles Darwin, F.R.S., director of the Laboratory; Dr. A. M. Turing, who may be described as its creator; Mr. J. R. Womersley, superintendent of the Mathematical Division; and Professor D. R. Hartree, of Cambridge University.

A Misnomer?

INCIDENTALLY, Professor Hartree has written to *The Times*, deprecating the use of the term "electronic brain" as descriptive of the American and similar inventions. He is possibly the only person in this country who has actually inspected and used the Eniac. He emphasises that such a machine is not a substitute for the thought of organising the computations, only for the work of carrying them out. "These machines," he writes, "can only do precisely what they are instructed to do by the operators who set them up. It is true that they can be set up in such a way as to exercise a certain amount of judgment. But it must be clearly understood that the situation in which judgment has to be exercised, the criteria to be applied, the way the results of applying these criteria are to be assessed, and the decisions as to the action to be taken on these results, must all be fully thought out and anticipated in setting up the machine." Professor Hartree is undoubtedly right in pointing out that the term "electronic brain" is misleading in that it ascribes to such machines capabilities they do not possess.

Plastics Exhibition

ALTHOUGH plastics are playing an ever-increasingly prominent part in our daily lives, few people realise how extensive is the range of articles now being produced in this field. By many, indeed, the term "plastics" is vaguely associated merely with what are regarded as war-time makeshifts in the way of clothing or furnishings, and they remain in complete ignorance of the fact that many of the most useful articles in common use are made of plastics. It is all to the good, therefore, that an opportunity should be afforded to the general public of seeing some of the latest plastic developments and for this reason the exhibition which has been organised by the *Daily Graphic* in association with the British Plastics Federation, should prove worth while. The exhibition, which is being held in Dorland Hall, Lower Regent Street, London, W.1, from 10 a.m.-7 p.m. daily until November 27, contains everything imaginable from dentures to a perspex violin. In the section dealing with medical and technical goods are artificial eyes, a B.D.H. Lovibond Nessleriser, and the now famous polythene wrapping for mepacrine tablets. The toy section is a veritable children's paradise, and any child would enjoy the model playroom. Special exhibits—which will arouse particular interest among home-lovers are a dining room and bathroom completely furnished and panelled from floor to ceiling in plastic materials which, it is claimed, are non-inflammable and not affected by water or acid.

CONFERENCE ON EXPORT

Delegates from all parts of Britain, representing a wide range of industries, will attend the Export Conference which the Federation of British Industries will hold in Central Hall, Westminster, London, S.W., on November 27 and 28. Means by which Britain's export drive can be further strengthened will be defined and discussed. Mr. Leslie Gamage will be chairman of the conference and it will be opened by Sir Clive Baillieu, president of the F.B.I. Among other speakers will be Sir Stafford Cripps, M.P., President of the Board of Trade; Lord Bennett, former Prime Minister of Canada; Sir John Woods, Permanent Secretary of the Board of Trade; Sir Norman V. Kipping, director-general of the F.B.I.; and Sir Frederick Bain, deputy-president.

The U.S. and U.K. Governments have accepted the invitation of the Dutch authorities to attend a meeting at The Hague on November 25-30 of the International Rubber Study Group. Mr. D. D. Kennedy will represent the U.S. while the U.K. delegation, in addition to Government officials, will include unofficial members representing the rubber industry.

Heat for Drying

Its Application in the Chemical and Allied Industries

THE importance of drying in industry was recognised by the allocation of a whole section comprising three sessions to this subject at the recent Ministry of Fuel Conference: "Fuel and the Future." The evaporation of moisture is one of the most common of all physical processes in industry, but the term "drying" is not confined technically to that single aspect of the subject. It has been defined by Rabold (*Amer. Dyestuff Reporter*, 34, 108-117) as "the removal of any volatile substance from a fibre, fabric, material, or surface, by means of energy in the form of heat."

This, however, is by no means the full extent of what is now termed drying because the "drying" of paints and the hardening of plastics are both now brought under the term "drying." The Ministry of Fuel Conference comprised all these processes and also included factory heating and air conditioning, which may be said to be concerned with the evaporation of water from the human body, together with heat for agriculture and horticulture which involves the drying of grass, grain, and other agricultural products. Some of the "high lights" of the discussion of particular interest to the chemical industry will be considered here, but no attempt can be made to give a full account of all the papers presented.

Paints and Plastics

Three papers dealt with the "drying" of paints and plastics, an operation which is probably better termed "curing" and will be so described here. Attention has been focussed upon what is termed "radiant heating" for this purpose by the success which has been achieved in reducing the curing times from hours to minutes and even to seconds. Published data furnish examples of the substantial reduction in the curing time of modern paint finishes effected by the use of radiant heat; it has been stated that many paints requiring ten to thirty minutes in convection ovens can be processed in one to eight minutes by radiation, and in certain cases the reduction was very much greater, *e.g.*, times of 60-90 minutes being reduced to 0.5 to 4.5 minutes. Claims have been made for the successful application of this method to the drying and processing of textiles, and to the drying of ceramic articles and of many other industrial materials.

The method used is to allow the materials to travel through a tunnel, the sides of which contain electric filament lamps operating with a wire temperature of about 2200°C. or gas heated panels which may be heated to what are termed medium temperatures of 450-650°F. (232-343°C.) or to higher temperatures of 700-1000°C. For almost all normal curing, and particularly for metal finishing processes, temperatures up to 650°F. are sufficient. The radiation from these sources falls directly upon the surfaces to be cured and is there absorbed, raising the temperature to the required degree. It is clear that these processes may be most usefully applied to those operations in which the speed of reaction increases rapidly with temperature. The polymerisation of certain types of paint exhibits this characteristic in a marked degree, and it is in applications of this nature that the most startling results have been achieved.

Choice of Two Processes

Two papers, one by J. C. Lowson, of the B.T.-H. Research Laboratory, and the other by R. F. Hayman, of the Gas Light & Coke Co., dealt with this subject from the point of view of radiant heating by electric or gas equipment. This process must be in competition with the older process of convection heating, and the conference revealed a striking divergence of opinion as to the relative merits and fuel consumptions of the two processes.

It may be mentioned that the first report on radiant heating by the Gas Research Board, a report written by A. L. Roberts and R. Long in 1945, claimed that no hard and fast rule could be laid down as to whether radiant heating or convection heating was the best. The report pointed out that consideration of the fundamental principles of heat transfer by radiation shows that the extent to which radiation can replace convection methods of heating has limitations, which are largely imposed by the nature of the material being irradiated. It would be evident, for example, that if the material to be treated happened to have a low coefficient of absorption, radiant heating would not be satisfactory. There may also be limitations when the temperature of the objects to be treated begins to approach that of the emitting surface. The high temperature of the electric filament does not give the electrical method of heating any particular advantage in this respect since the filament must be enclosed in glass, and the glass cuts off most of the rays above 30,000 Å.

The marked reduction in the time spent in the oven secured by the radiant heating method suggests that the fuel consumption by this method is very much lower than by purely convection methods for this particular class of work. Moreover, according to theory, it should be possible to cure the

paint on the surface of a heavy engineering product without having to heat the whole mass of the metal to this temperature. It is possible to turn off the heat from the filaments or panels at any time when the machine is not in use and to start up again with very short delay. There is thus every reason to suppose that this method will not only save time and vastly increase production per unit of plant, but that it will also be economical in fuel consumption.

Use of Conveyor Oven

This view, however, was controverted by Mr. A. M. Lehmann (of F. J. Ballard & Co., Ltd.), who maintained that the conveyor oven is equally as effective in rapidly curing paints by radiant heating and operates with a very much lower fuel consumption. By a conveyor oven is meant a direct-fired convection oven through which hot air is circulated and through which the goods travel on a conveyor. In the radiant heating system direct radiation must fall on the surface to be treated. If the surface happens to be an awkward shape, such as with a large flat panel, the objects must travel through a radiant heat tunnel "in line ahead," whereas if convection heating be used the tunnel can be fully filled since the hot air will circulate over the surfaces. Convection heating, moreover, will more readily heat up a surface of high emissivity.

Further, Mr. Lehmann reminded the conference that "a most important point to remember is that it is the paint that is the prime factor in quicker drying time, and not the type of oven alone which determines this more rapid form of drying." He claimed that "it has been determined that if speed of drying is considered of major importance, stoving can be completed in a conveyor oven just as quickly as in a radiant heat oven, and at the same time produce equal, if not better, results, provided the same type of paint is used in each instance For many years paint manufacturers have supplied, for general industrial use, colour stoving paints embodying an oil base, and it has been generally agreed that the drying time required for this type of paint was anything up to one hour at a temperature of 250° to 300° F. in a conveyor oven. During recent years great developments have taken place in paint manufacture, and, briefly, I would refer to two paints now generally known to industry as urea formaldehyde and medium alkyd resins, both of which can be subjected to higher and greater variations of temperature, and can be stoved in quicker time than oil base materials. It is paints of the urea formaldehyde and alkyd resins which are generally used in conjunction with radiant ovens."

Mr. Lehmann gave some striking figures claiming that whereas a radiant heat oven using gas emittors would require from 7 to 11 cu. ft. of gas per cu. ft. of tunnel space, the conveyor oven would do the same work with the gas consumption on a similar basis of 0.22 to 0.69 cu. ft./cu. ft. of tunnel space. There is here a direct conflict of opinion which will no doubt be cleared up in due course by the Gas Research Board. The most that can be said at this juncture is that each project must be individually investigated to ascertain whether radiant heating or convection heating will give the best results. So far as radiation is concerned the report of the Gas Research Board previously mentioned states that "in the majority of the applications of radiant heating so far examined, the opacity of the materials concerned must result in surface absorption of the incident radiation, irrespective of the wave-lengths employed. In this respect, therefore, the quality of the radiation used is of no consequence and whether electric or gas-heated sources are preferable in such cases is largely a question of which will provide the necessary intensity of radiation for the lowest capital and running costs."

It may be mentioned here that the curing of paints and the polymerisation of plastics are by no means the only application of radiant heating which is also being applied to the drying of comparatively thin articles, less than 1-1¼ in. in maximum total thickness. The evaporation of water, however, seems to be an operation for which other drying systems are generally better equipped.

Spray and Roller Drying

Spray and roller drying for the purpose of evaporating to dryness were described by Mr. E. H. Farmer and Mr. C. G. Six, of Glaxo Laboratories. The authors point out that the meaning of the expression "evaporate to dryness" is by no means as simple on the large scale as might be expected. When the problem is merely to recover a solid which will crystallise readily from a concentrated solution, the obvious procedure is to remove water in an evaporator and to allow crystallisation in the same or a different vessel. Where, however, it is necessary to handle a liquid that can be dried down into a solid condition without crystallising, the problem is very different. If evaporation is carried out in pans or trays it is usually slow and difficult to control, and may be attended by gross wastage of labour in removing the dried material. Moreover, if the product is sensitive to heat, drying in pans or trays will often cause damage. To overcome these difficulties recourse is often had to roller drying or spray drying.

Roller drying consists in the application of the substance to be dried in a thin film to the smooth surface of a continuously rotating heated metal drum. Drying is

completed in less than one revolution of the drum, and the dried material is continuously scraped off the drum by a stationary knife, known as a "doctor" knife. Roller dryers may comprise single or multiple drums. For drying most liquids one or two drums are usually employed; in the paper industry large numbers are used. Almost always the drums are heated by steam under pressure. The roller dryer will always be popular because of its relatively low initial cost, space-saving, compactness, and simplicity and economy of operation with the minimum of accessory plant likely to introduce complications. With the conditions of operation properly worked out it is capable of a very high evaporation rate and low steam consumption.

The steam consumption of a well-arranged roller dryer should not exceed 1.5 lb. per lb. of water evaporated. The capacity will vary considerably with the nature of the material being dried and may be as much as 8 lb. of water evaporated per sq. ft. of drum surface per hour. The most important variable to be fixed in roller drying is the thickness of the film of liquid carried round on the roller. On a single drum machine the thickness of the film is usually adjusted by means of an additional small spreading roller. Double roller machines are usually arranged so that the drums revolve in opposite directions, turning downwards towards each other when viewed from above, and the gap between the rollers is adjusted to give the desired film thickness.

Three Related Variables

As the drying period is limited to the journey of the film between the feed and the scraper, usually less than three-quarters of a complete revoluton, it is clear that the steam pressure, film thickness, and drum speed are three related variables controlling drying for any given diameter of drum. The steam pressure may be determined by external factors, such as the availability of pass-out steam from electric power units. It is generally possible to dry successfully by means of steam at a pressure of 15 lb. to 20 lb. per sq. in., but the low output means heavy capital cost in drying equipment. Higher steam pressures involve a saving in the size of plant, but may introduce complications if the material is heat-sensitive.

Most drying operations are carried out at steam pressures between 50 lb. per sq. in. and 100 lb. per sq. in. Milk dryers usually operate at 15-16 r.p.m. Other products may require speeds as low as 1½ r.p.m. For general purposes a variable speed gear is desirable. The consistency of the mix fed to the machine is important. If it is too thick it may be difficult to obtain a uniform and thin film. Uniformity of moisture content and of composition, with heat-sensitive materials, depends on the maintenance of a uniform film thickness. The uniformity of the film is affected by the uniformity of the clearance between the drums over their entire length, by uniformity of level in the trough, by uniformity of the feed, and by the efficiency of removal of the dried film. As the drums bulge slightly under pressure, low steam pressures are an advantage in ensuring a uniform film.

Removal of Air

The air entrapped in the drum and the steam condensate must both be continuously removed to maintain thermal efficiency. One per cent of air in the drum may reduce heat transfer by as much as 11 per cent. The importance of correct choice of steam pressures and roller speeds, the correct selection and careful maintenance of film thickness, and the maintenance of the whole plant in good condition are basic principles of fuel efficiency in roller drying. In addition the use of sufficiently high steam pressure in the boiler should always be considered in order to enable a steam-driven generator to be used, exhausting or passing out steam at the pressure required by the dryers.

It is commonly found that the whole of the power required for driving the dryers and auxiliary equipment can be obtained in this way from a back-pressure engine exhausting at, say, 50 lb. per sq. in., with an initial boiler pressure not higher than 200 lb. per sq. in. It may be practicable and desirable to increase the throughput of the drums by pre-heating the liquor to be dried, and this can be achieved either by utilising the condensate from the drums or by steam heating. Whichever course is followed the condensate from the drums should be utilised for boiler feeding, appropriate steps being taken to avoid, as far as possible, loss of heat in "flash steam." Attention should, of course, be given to efficient lagging and to the choice of steam lines and valves of adequate diameter. It is not unusual to find cheap and inefficient reducing valves on each individual machine when one relay-operated reducing valve serving a whole battery of machines would represent little more in capital expenditure, but would make for better control and consequently would save steam. A good flow of air over the drum often enables the machine to work with considerably lower steam pressures.

The authors do not appear to be greatly in favour of vacuum drum dryers and they point out that the temperature of the dried solid may approach that of the heating medium in a vacuum dryer just as in a dryer operating at atmospheric temperature. In an ordinary twin roller dryer the time of contact is normally very small, and heat-sensitive materials can usually be dried without damage. For example, unequivocal tests have demonstrated that no appreciable destruction of Vitamin C, the most heat-

sensitive of the known vitamins present, occurs when milk is dried by the roller process.

The spray dryer is a versatile plant which can be adapted to a great variety of conditions and substances. It is particularly suitable for the drying of heat-sensitive materials and products required as fine free-flowing powders with fixed limits of moisture content.

Little Difference

There is often little to choose between spray drying and drum drying. The drying time is much shorter for spray drying, about 0.1 secs., compared with 2-3 sec. for drum drying. The surface in contact with the hot drum is hotter than the exposed surface of the material, and the product from the drum usually needs to be ground and sieved. On the other hand the drum dryer has a better thermal efficiency amounting to about 1½ lb. of steam per lb. of water evaporated compared with 2-5 of steam for the commercially available spray dryers. Moreover, the drum dryer is capable of drying types of material like thick pastes and fibrous slurries which are extremely difficult to spray dry. There is little difference in capital cost for large installations, but the drum dryer is cheaper for small outputs; where the physical characteristics of the product are not of major importance it would be the better choice. The drum dryer is more economical of space, as the spray dryer requires considerable head room.

Spray dryers may be operated by direct heating in which flue gases are passed through the dryer in order to pick up the evaporated moisture, or they may be heated by air which has in turn been heated by steam or fuel in indirect heaters; much depends upon what types of fuel are available, and upon the effect on the products of any impurities that there may be in the flue gases.

Where an adequate supply of flue gas is available, heating by flue gas is undoubtedly an extremely economic method. Its chief drawback is the necessity for a very large heating surface owing to the low rate of heat transfer between the gases and the metal surfaces. It also calls for the provision of forced draught to the furnace. Serious corrosion of metal may occur if the gas is cooled to a temperature below its dew point.

The method of admitting the hot air to the drying chamber is of necessity closely related to the method adopted for atomisation of the material to be dried. Rapid and uniform contact between the hot drying air and the atomised particles has been extremely difficult to achieve in practice, and it is in this operation that great thermal losses can occur. Three atomisers are in general use, namely: (1) the pressure atomiser; (2) the compressed air atomiser; and (3) the high-speed rotary disc atomiser. Each one of these types has both advantages and disadvantages, and careful consideraton must be given to the selection of the most suitable type for the particular material to be dried.

The most general primary cause of low efficiency is the coarseness or unevenness in size of the sprayed particles. The drying time of a particle increases with the square of its diameter, and its speed of fall also increases with the square of its diameter, so that an increase in particle size rapidly decreases the rate of drying and also the time available to dry. This effect of the particle size on the rate of drying shows how important is the function of the atomiser, for even if the majority of the particles are of the right size a few larger ones will compel an uneconomical adjustment of the drying conditions to deal with them.

In general, the bulk of the dry material settles out in the drying chamber, where there are facilities for its removal. The air from this chamber then passes through a cyclone or multiple cyclones, and finally through a dust filter which removes the last of the dust. The dust filter may be replaced by a spray tower or by an electrostatic precipitator. In practice there does not seem to be any necessity to use cyclones followed by dust filters. Dust filters are designed on the basis of air throughput alone and consequently no reduction in size would be achieved by prior removal of the greater part of the dust in a cyclone. The principal disadvantage of the cyclone, and more especially of the small multiple units, is that they cause considerable heat losses. Elimination of the cyclone conserves heat, and the increased dust supply to the dust filters need cause no inconvenience if they are of the modern automatic type.

Recoverable Heat Negligible

In an economical plant working with non-hygroscopic material, the air should leave the drying chamber at about 70°C., with a relative humidity of 30 per cent, the dew point of which is 47°C. The recoverable heat is negligible. For this reason recirculation or partial recirculation of the air is not economically justifiable except when an inert gas must be used instead of air. If recirculation is necessary the humid gas from the dryer can be passed through a condensing tower sprayed with cold water, and the cold gas then sent back to the gas heater. Little thermal economy is possible because of the low temperature differences and the very low rate of heat transference in the gas/gas system. It must be emphasised that when thermal efficiency alone is considered, the size and working conditions

of a spray dryer must be determined for every material to be dried, for it is very infrequent that a spray dryer designed and operating at optimum conditions for one material can be made to work with another substance without some loss of efficiency.

Mr. A. S. White dealt with the application of the atmospheric tray dryer to the drying of chemical products. There are many chemical products which require special drying techniques either because of their chemical nature or because of their physical nature. Many chemical products are made in quantities large enough to warrant the use of dryers specially designed for them, and these dryers are often of the continuous type.

For general utility in factories where materials are made by batch processes in relatively small quantities the atmospheric tray dryer still stands supreme despite the labour -saving claims of the small agitated dryers of the pan or cylinder type. There are hundreds of atmospheric tray dryers in this country, and there is probably no chemical works that has not at least one, and many have no other type. The paper was, therefore, confined to the atmospheric tray dryer, and in particular to the steam heated types.

Cost of Labour

Labour is the greatest single item in the cost of tray drying, a typical division of costs being:

Labour	57.0	per cent of total cost.
Steam	38.0	,, ,, ,, ,,
Electricity	2.5	,, ,, ,, ,,
Maintenance	2.5	,, ,, ,, ,,

In many cases, too, the cost of drying is a small proportion of the total cost; it certainly is so in the organic chemical industry. Steam saving at the drying stage, therefore, has only a small influence on the cost of drying, and a negligible influence on the total cost of a product, and for these reasons there is little apparent incentive for improvement in steam efficiencies. However, "every little helps," and the author discussed briefly some factors in design and operation which affect steam usage.

It is difficult to establish a universal criterion of efficiency; thermal efficiency varies widely according to the degree of dryness required in the product and also on drying temperature. Steam consumption can range from about 2 lb. steam/lb. water evaporated for material dried at 100°C. to 2-3 per cent moisture content to 6-8 per cent or even higher for material dried to 0.1 per cent moisture.

Thermostatic control is, of course, very desirable and the air-operated types are to be preferred especially for dryers in which the drying temperature is changed frequently, although the direct or relay-operated hydrostatic types gives reasonable service. It is important that the steam valve is selected to suit the load, and in some cases it is best to by-pass the thermostat control during the heating-up period.

Radiation losses account for a third or more of the total steam used; a four-rack dryer at 100°C. uses about 40 lb. steam/hr. to cover radiation losses. The majority of commercial dryers, however, have the economic amount of lagging, and extra lagging rarely repays its cost.

It is rarely practicable to recover heat from the air leaving the dryer, but it is obviously desirable to reduce the amount of heat lost in this way to the lowest possible quantity, and this can be done by intelligent use of the dampers. Often it is possible to work with one damper opening—the smallest—throughout the drying, but with very wet paste it may be desirable to start with a wide damper opening and then closing down after a set time.

All-Ceramic Dryers

In the standard type of dryer this procedure can be adopted without difficulty because the fans can take care of the internal air circulation whatever the proportion of air recycled. In some cases where exceptional cleanliness is required or where corrosive vapours are present, dryers of all-ceramic construction are being used in which internal recirculation is obtained by the use of a low-pressure air injector. These dryers do their job excellently; but their thermal efficiency is limited by the low entrainment of the injectors which recycle only about 25 per cent of the air; a standard type of drier recycles 75 per cent or more.

Damper control from the humidity of the exit is only worth-while when the drying characteristic of the products require humidity control, and such control is rarely required in the drying of chemicals.

The principal defect of the atmospheric tray dryer is that drying is not uniform throughout the dryer; some trays dry long before others, *e.g.*, in a pigment drying at 100°C. some trays were dry enough after 36 hours, but the bulk required 48 hours. The usual cause of this effect is non-uniform distribution of air; the use of adjustable louvres to equalise air distribution has some effect, but by no means overcomes the difficulty. Increase in air velocity at the expense of increase in power consumption also has some effect, but air velocity is frequently limited by the dusting characteristics of the product, and for general purposes no alteration in air velocity is permissible.

In low-temperature drying, non-uniformity of drying and sometimes spoilage of product can be attributed to direct radiation from the heating elements. External air heaters are the best solution, although hot-water heating can be used as an expedient. Improvement in uniformity of drying really

requires drastic re-design, and can hardly be achieved without increasing dryer cost. Heat is lost in heating up the dryer and its charge and is not recoverable at the end of the drying operation; it is obviously best to use the largest practicable charge. Trays should be loaded uniformly, and although one would expect an optimum charge it is often found in practice that drying time, especially at high temperatures (100°C.), is roughly proportional to tray loading.

The foregoing points deal with design and operation, and it is unnecessary to mention that the heating of dryers can often be done with exhaust steam at 10-20 lb./sq. in. gauge or even with hot-condensate where low temperatures are required.

Biggest Savings

The biggest savings in steam and in over-all drying cost can be obtained by reducing the amount of water charged to the dryer, *i.e.*, by increasing the solid content of the charge. Not only is there a steam saving, but an increase in dryer output too, *e.g.*, the total cost of drying varies inversely as about the 1.25 power of the solids content of the paste for the drying of dyestuffs and pigments at 100°C. A study of precipitation and filtration conditions to reduce the mosture content of the paste is therefore the most fruitful line for the chemical manufacturer to follow and offers more than mere improvement in dryer efficiency.

Something should be said about the "through-circulation" dryer, *i.e.*, a dryer in which hot air is passed through the mass instead of over it. This type of dryer gives much shorter drying times than the conventional tray type because evaporation of water or solvent is not controlled by diffusion or capillarity to anything like the extent that it is with the latter type. Thus, the heat losses by radiation, etc., are a much smaller proportion of the total heat used—in ordinary tray dryers the amount of water evaporated towards the end of the drying operation is very small compared with the steam used. The through circulation technique, familiar in the Quinan and some commercial forms of band dryer, is, however, applicable only to crystalline materials or to materials which can be granulated or otherwise made into small lumps. A batch dryer of this type should be particularly useful and give good thermal efficiencies for the low temperature drying of small production materials.

China clay is a substance requiring special technique for drying, and this was discussed by Mr. C. R. Love. In years just prior to 1939, production of china clay reached 850,000 tons per annum, and is expected to exceed this figure in the near future. The coal consumption for this output exceeds 100,000 tons a year, and is an important item in the cost of production.

In the early stages the process is entirely wet, and dewatering proceeds by gravity or by pressure filtration to the point where heat is applied to obtain the required degree of dryness. About 85 per cent of the total output is dried to 10 per cent moisture and 15 per cent to 1 per cent moisture for disintegration and bagging as a powder, and it should be borne in mind that the cost of drying must be reckoned in shillings per ton of product. It is therefore not possible to introduce intermediate losses such as are associated with electricity or gas into the process.

The fine particle size, which in certain grades is 55 per cent below 1 micron, and the need to avoid calcination by high temperature, impose certain limitations on the methods adopted. The combined moisture begins to disperse at temperatures around 400°F., and this must be retained.

The older and still the principle method of drying is to settle the clay from a thin slurry to a semi-plastic state containing 45-50 per cent of water in large rectangular tanks arranged alongside a drying floor, which is generally 250-300 ft. long by 15-18 ft. wide, on the opposite side of which, at a lower level, is the dry store. The drying floor is composed of porous firebrick tiles laid on flues, which are heated by hand-fired coking-type furnaces; the length of flue is sufficient to reduce gases to 250°F. when correct conditions are observed. The semi-plastic clay is laid on the hot floor and makes a bed in complete contact with the tiles. Evaporation proceeds partly by evaporation above the bed and partly in the flue by seepage of moisture through the tile.

Filter Press

Using a high volatile large coal it was possible to obtain overall efficiency of 50 per cent when drying the clay from initial moisture of 45-50 per cent to 10 per cent, but inferior fuels have led to less satisfactory results. Hand labour with scoop, shovel, and wagon is used entirely in these kilns. A later development now being rapidly extended is the use of the filter press to replace the settling tank. This cuts out the settling period of several weeks, and consequent chance of contamination, and reduces the moisture content to 28-33 per cent, according to the particle size and other qualities of the clay.

The filter press cakes do not make complete contact with the hot floor and the heat efficiency is reduced to 38 per cent, but in spite of this there is a reduction in the fuel consumption by 40 per cent. The main concern here is fuel economy, but the producer cannot disregard other factors in the total cost.

An economy in fuel has been affected by filtration, but only by the introduction of other factors, and by the use of scarce com-

modities such as labour, cotton cloth, and iron castings, and by use of power for pumping the clay slurry to the filters at 100 lb. per sq. in. The result shows no overall economy over the old methods.

The ever-increasing demand for powdered clay calls for drying to 1 per cent moisture, and for this purpose the hot floor is quite unsatisfactory owing to the need to reduce the temperature to avoid calcination and consequent loss in output. The extra fuel is out of proportion to the small reduction in moisture.

The designer, then, is faced with two main problems:

(1) To reduce labour costs by introducing mechanical handling of the wet filter press cake to continuous dryers, and thence to store.

(2) To find a high efficiency dryer mainly for the total drying of clay for disintegration, but also capable of use for bulk clay dried to 10 per cent. moisture.

Machine Problem

Considerable exploration has been undertaken in both these directions during the last few years. For the first objective an indirectly-fired rotary kiln was required, and it appeared that no such machine was readily obtainable in this country, and an American design had to be built. Difficulties in cutting the clay to suitable sizes and feeding continuously were overcome, and fuel consumption has been ascertained under normal conditions.

Using a hand-fired coke furnace the efficiency is not better than the hot floor, *i.e.*, about 38 per cent, from which has to be deducted the power for driving the kiln and its auxiliaries, which is considerable. A large machine with chain-grate stoker using small coal is now nearing completion, and it is hoped that the superior control of combustion and temperature will lead to good results.

For the second problem low temperature is essential and here again a suitable machine was difficult to obtain. Tests were carried out on a steam-heated rotating shelf machine constructed of a number of shelves with segmental trays. Within the shelf system blowers are located, and the heating elements are arranged around the outer periphery of the dryer. Multiple circulation and reheating of the air is effected by the blowers, and complete drying is assisted by repeated turning of the material as it progresses from shelf to shelf on its passage through the machine.

The quantity of hot vapour escaping to atmosphere is controlled according to humidity, and efficiencies of 70 per cent based on steam consumption to moisture evaporated were obtained when drying to 10 per cent moisture, and of 50 per cent when drying to 1 per cent moisture. The power consumption of this dryer is low. These results were obtained using steam at 60 lb. g., but there is reason to believe that much lower pressures can be used at the cost of reduced output from a dryer of a given size.

At all stages of production electric power is used and it is found that a very close balance exists between the power requirements and that which can be produced by a correct choice of initial pressure to the turbines and heating steam pressure when using back pressure or pass out turbines. The obvious course to adopt, therefore, is to install electric power plant and dryers adjacent to each other and choose steam conditions most suited to the combination. A large plant on these lines is now in course of construction making use of drying units of 7½ tons per hour each from which the maximum heat efficiency is expected. Calculation shows that 35 per cent to 40 per cent of the total fuel bill can be saved by the adoption of this method.

Considerable practical difficulties must be overcome to concentrate the drying and storage capacity into sufficiently large units to make this scheme applicable to the whole industry, but there is no doubt that along these lines lies the possibility of achieving those economies in fuel which are of such paramount importance to all industrial undertakings where fuel is a large item in their general costs as well as to our country as a whole.

Non-Ferrous Metals

Consumption in the Third Quarter

DETAILED figures of consumption of non-ferrous metals in the U.K. during the third quarter of 1946 covering zinc, lead, tin, cadmium, and antimony, have been issued by the Ministry of Supply Directorate of Non-Ferrous Metals, together with tables showing consumption of virgin metals and scrap for the various trades. Total figures, in long tons, of the consumption of virgin metal in the first, second, and third quarters of 1946 are as follows:

	First Quarter	*Second Quarter*	*Third Quarter*
Zinc	50,653	51,548	53,865
Lead	55,426	48,013	45,913
Tin	5421	6449	6593
Cadmium	127	138	144
Antimony	1490	1274	1532

Consumption of scrap metal in the third quarter, in addition to the above, was (in long tons) as follows: zinc (including re-melted), 18,312; lead (including lead refined in the U.K. from scrap and home-produced ores), 33,142; tin, 1796; antimony, 820.

B.A.C. Ballot

Result Against Affiliation with T.U.C.

THE result of the ballot recently con ducted among members of the British Association of Chemists on the question of whether the Association should, or should not, affiliate with the Trades Union Congress, has been announced as follows: For, 557; against, 581. This gives a majority of 24 votes against affiliation.

In this connection we have received the following letter to the editor:

SIR,—The publicity which you have accorded the ballot recently held by the British Association of Chemists on the question of affiliation to the T.U.C. is most welcome, but it is important that the matter should be viewed in correct perspective. Chemists have treated this issue as a political one and the voting has been roughly on the same lines as at the General Election. Were any other chemical body to put the same question to its members it is doubtful whether the result would have been markedly different.

Twenty-eight years ago the British Association of Chemists was formed to serve the economic interests of chemists. It was hoped that on this aspect chemists might be persuaded to unite and support one body in such numbers as would enable it to speak with authority for the profession. Its three grades of membership cater for all types of chemists. It became a trade union in order that it might enjoy certain legal rights to negotiate on behalf of chemists. It established an unemployment fund to protect chemists in times of depression. No other chemical body has such a fund, which to-day has a reserve of £41,000 with which to support such of its members who might otherwise be compelled to accept positions on terms that might depress the general level of salaries of all chemists. Its appointments list may fairly be claimed to be the most comprehensive list available to chemists. By means of its legal aid fund it has established valuable legal precedents on behalf of chemists.

The British Association of Chemists has consistently encouraged its members to support other chemical bodies. It has pursued a policy of moderation and has sought to unite all chemists in a common policy and to collaborate with other chemical bodies to this end. For many years the B.A.C. advocated the formation of a comprehensive register of chemists: not necessarily its own register, but one which would embrace all chemists. In the absence of such a register, the Government found it necessary to establish the Central Technical Register, which is not under the control of any of the chemical bodies. Thus, what chemists failed to do voluntarily has been thrust upon them from above. In these days of pressure groups and extremist activities, it is permissible to speculate in what other ways the interests of chemists may be assailed under the stress of economic or political events. Every passing year renders the unification process more difficult of attainment, and increases the chance of chemists being squeezed between rival interests.

Is it not time chemists decided to be chemists first, and adjectival chemists afterwards—to put the interests of the profession as a whole to the fore, and behind a united front indulge their passion for individuality in some degree of security? Instead of splitting the profession, may we not take heart and make this ballot the stepping-stone to higher things? If chemists will act now they may be assured that they have the fullest opportunity of controlling the policy of a body of their own choice. If not, they can hardly complain if they lose control of their own destiny.—Yours faithfully,

H. L. HOWARD,
Hon. Registrar, British Association of Chemists.

London, W.1.

Seaweed Industry

Large Scale Scottish Experiment

IT was reported from Inverness last week that the Treasury has authorised the expenditure of £5000 for the purpose of carrying out a large-scale experiment in the collection and drying of seaweed. The experiment, which will take place at Lochmaddy, North Uist, will be carried out over 20 weeks.

A start will be made early in March, it is hoped, and already boats and other items of equipment have been secured. It is estimated that there is in the area of Lochmaddy and Loch Eport 60,000 tons of seaweed available for cutting. If the experiment proves commercially successful a recommendation to establish a factory at Lochmaddy may be put forward. The proposed factory would be responsible for cutting, drying, and grinding seaweed, and would give employment to many people in North Uist.

During the war extensive use of seaweed extracts was made by the Scottish Seaweed Research Association. This body will carry out the experiment at Lochmaddy, on the recommendation of the Scottish Provisional Seaweeds Committee set up by the Secretary of State for Scotland last December.

A wide field is covered by the products of Venner Time Switches, Ltd., Kingston-by-pass Road, New Malden, Surrey. Several meters and gauges of particular interest to the chemical manufacturer are described and illustrated in the latest price list.

SAFETY FIRST

Amenity as a Feature of Chemical Works—IV

by JOHN CREEVEY

THE Minister of Transport, with the authority of Parliament, has recently distributed copies of the revised Highway Code for the guidance and safety of all road users. In his foreword he tells us that "in every human activity there is a standard of conduct to which, in the common interest, we are expected to conform"; and adds that the provisions of this Code are a simple summary of the best and widest experience, and each provision, whether it relates to a legal requirement or to discretionary behaviour, has been included because of its importance in preventing road accidents.

Considered apart from the question of road safety, this Highway Code may profitably be studied by employers and employees alike in every industrial environment, for a little commonsense thinking will point out analogies For instance, under the heading of "Hints on Cycling" we are reminded that a bicycle is not in good condition if, among other things, the wheels are out of line, the chain is slack, or the tyres are badly worn or soft. It is the same with machinery; to be safe for those who are in contact with it, machinery must be kept in good running order. Moreover, the nature of the machinery must be perfectly understood by those who attend it, by those who undertake the maintenance of its good working condition, and by those who are responsible for seeing that safeguards against accident are properly installed and that the correct procedure is observed in their operation.

Workers' Comfort

But even with due attention to all points of maintenance and operation, and with extensive education of the worker in measures of safety, it might still be difficult to attain the ideal achievement of complete freedom from accidents if attention was never given to this sense of things which may be summed up under the word "amenities."

Men—and women—work best when they have a certain measure of comfort as regards the conditions under which they have to do their work. It has been within only recent years that employers have come to realise this, and in many cases have wisely taken steps to provide good working conditions, sometimes prompted, it is true, by gentle pressure from Acts and Orders formulated with the safety of the individual worker in mind.

Good artificial illumination in the absence of adequate natural daylight, and the provision of efficient ventilation which operates simultaneously with the removal of fumes detrimental to health or which are merely distasteful, are prime essentials for comfort of working, and at the present time there is no excuse for the existence of adverse conditions. Added to this, the worker needs adequate facilities for washing, not only before meals and at the end of the working shift, but perhaps at intervals more frequent according to the precise nature of his work.

Cleanliness

With good ventilation of the working space, the brain becomes more alert, and even in this way alone the incidence of accidents is noticeably reduced. Freshness, acquired by washing the hands and face, is also a great tonic to the worker, especially in certain aspects of industry; he is an unwise employer who denies the worker the fullest facilities for washing himself during working hours as well as immediately before meals and at the end of the shift. The washing needs of the individual, however, do not stand alone; there is also the necessity to clean the environment in which the worker moves in the course of attending to his duties. In certain cases this matter of environment is more acute than it is elsewhere; the need to clean-up may come only at the end of the shift, at other places more frequently, and the cleaning may include washing down the floor, as well as parts of the plant.

Only when executives make periodical tours of inspection, or better still, actually engage in routine work about the plant, are they able to realise this need for cleaning-up and the manner in which the ultimate environment increases the efficiency of the worker. Even the worker who is regarded as habitually lazy shows evidence of improving as a result of a clean environment, and will develop into an asset after due measure of time.

Apart from those points which have been mentioned—ventilation, lighting, washing facilities, and facilities for taking meals under safe and comfortable conditions—there is another matter which does not receive all the consideration it demands. This is the internal decoration of the various buildings which comprise the works, and the

upkeep of the works generally. A little more attention devoted to the yards, roadways, and spaces between buildings, would make many works far more pleasant than they are at present. It is true, of course, that wartime conditions of working, and perhaps restricted accommodation following war damage, have prevented recent attention to cleaning-up the works site, but it is significant that certain industrial concerns which in pre-war years devoted much time and money to providing a pleasant outside environment have been foremost in the work of re-establishing pleasant conditions after nearly six years of activity in the war effort.

Pleasing Colours

As regards the interior of individual buildings, the judicious application of paint and distemper in pleasing colours has already been proved to have a good psychological effect upon the workers, but its advantage does not end there. The freshness of the walls of a building, finished in light colour, aids materially in the distribution of light, both natural and artificial. To reach high efficiency, the actual tint should be chosen with due regard to the nature of the work carried on, the relative concentration of work-benches, and stacked material, and the extent to which natural daylight gains admittance or artificial light is provided. Before selecting any particular colour, it is wise to consult the firm which installed the artificial lighting, for their experience in these things is not to be ignored.

There is a vast difference between plant which is poorly lighted and that which has artificial illumination on scientific lines. Yet, all the same, the good work of the illuminating engineer may be wrecked by the application of colour entirely unsuitable for the lighting installed. Likewise, let it be remembered that the so-called "modern" or fluorescent lighting is not all that it has been claimed to be. Already, in street lighting, experience has shown that "blind" spots results, but worse still is the cumulative effect of permanent injury to the eyes of a proportion of persons who have to work where that type of lighting is installed.

Lighting needs proper maintenance. Although an artificial lighting system may be perfectly adequate when first installed, it will soon deteriorate in the absence of proper maintenance. Walls and ceilings, including roof steelwork, should be painted at regular intervals, and preferably in a light tone of colour. For the fullest admittance of natural daylight, windows and rooflights must be kept clean, outside as well as inside. With artificial lighting, there must be immediate replacement of bulbs and tubes when their efficiency drops below a certain minimum.

In all works with a large number of lighting points, it is wise to have means for checking the foot-candles of illumination received at any particular point, both inside the buildings and outside. The use of a foot-candle meter will automatically reveal the combined effect of all possible aspects of deterioration in artificial illumination. The cause of inadequate maintenance is generally ignorance of the extent of that deterioration; the result of deterioration undetected is loss of alertness on the part of workers, and accidents are likely to follow. Apart from accidents, deterioration in lighting has a depressing effect upon the worker, and may also become just as irritating as glare and other defects of a lighting system which has been badly installed.

In those cases where discrimination of detail is not essential, as in the work of handling material of a coarse nature, in grinding clay products, in handling ash, and in the charging of furnaces, the illumination demanded as a minimum is of the order of 3 to 5 foot-candles. Where moderate discrimination of detail is essential, as in such work as fine core making in foundries, the minimum is 10 to 15 foot-candles. These values are given only as examples of minimum illumination; the intensity of the lighting which is desirable for a particular operation is best determined by experience, thenceforth adhering to the value so found. Elderly persons, and persons with defective eyesight, always need more light than do persons with normally perfect vision.

BRITISH GAS COUNCIL

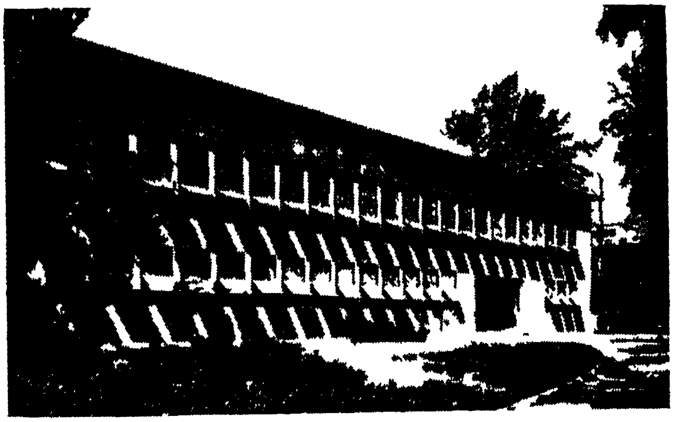
With the object of taking over all or part of the assets and liabilities of the unincorporated British Commercial Gas Association and National Gas Council of Great Britain and Ireland, the British Gas Council has been registered as a company, limited by guarantee without share capital. The original number of members is 1500, each liable for £1 in the event of winding-up. By Board of Trade licence, the word "Limited" is omitted from the title.

The Directors are Mr. R. J. Auckland, manager and secretary of Cardiff Gas, Light & Coke Co., Ltd.; Mr. Tom Brown, managing director of South Suburban Gas Co.; and directors or officials of the following: United Kingdom Gas Corporation, Ltd; Swindon United Gas Co.; Newcastle-on-Tyne and Gateshead Gas Co.; Bradford Corporation Gas Department; South Metropolitan Gas Co.; Helensburgh Town Council Gas Department; City of Leeds Gas Department; Tottenham and District Gas Co; Gas, Light and Coke Co.; Torquay and Paignton Gas Co.; and Southampton Gas, Light and Coke Co.

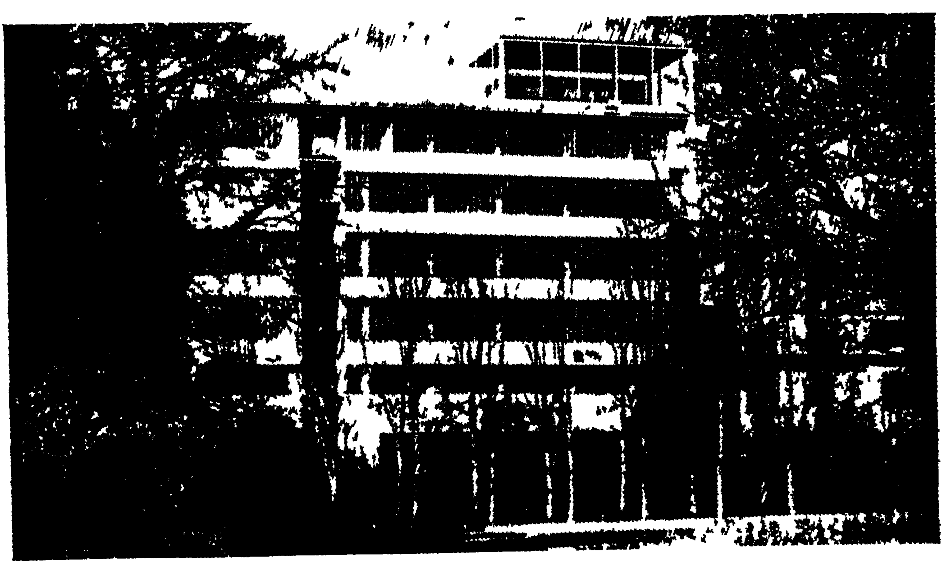
The general manager is Mr. J. R. W. Alexander; and the registered office is at 1 Grosvenor Place, London, S.W.1.

Swiss Laboratories

Striking Examples of Modern Architecture



Modern trends in Swiss architecture are admirably illustrated in these photographs of the laboratories of Hoffman—La Roche & Co., A.G., at Basle, the architect for which was the late Professor O. R. Salvisberg, of Zurich. The lower photograph was shown at the Exhibition of Planning and Building recently held in London under the auspices of the Royal Institute of British Architects.



British Paints for Abroad

Serious Decline in Export Values

PAINT manufacturers in this country are losing their overseas markets, according to a statement issued by the Paint Marketing Council. As a result of the shortage of raw materials for the paint industry, in particular linseed oil, manufacturers of paints and varnishes can execute only a fraction of their orders from India, the Middle East, South Africa, Latin America, the continent of Europe, and other overseas markets. The pre-war value of Britain's export trade in paints, varnishes and kindred products was approximately £4,000,000 a year. As a result of the present raw material restrictions, this figure is considered likely to drop to an annual rate of £500,000 or less for the current year.

"We are facing a very serious situation indeed, and are in danger of losing markets which have taken a century to build up," stated the secretary of the Paint Export Group. "Paints and varnishes made in Great Britain have long been acclaimed as second to none in quality in the markets of the world, but we may lose all this valuable trade, and the prestige that goes with it, unless raw material supplies to us can be substantially increased at an early date."

Before the last war, British manufacturers of paints and varnishes sent their products to every part of the world. Expert British chemists and research workers were constantly experimenting to produce paints and varnishes for every climatic variation.

Competition Overcome

Great Britain's best pre-war customers were India, the British Colonies, Latin America, South Africa, the Middle East, and some of the European countries, Scandinavia, Portugal, and Switzerland being among the best. Germany, Holland, Belgium, and France made practically all their own paints and varnishes. U.K. paints sent elsewhere in the world were able to surmount keen competition through their excellent quality. Even Canada, almost entirely self-supporting in paints and varnishes, bought from Great Britain certain specialised products of the paint industry.

U.K. manufacturers of paints for export suffered a drastic cut in their allocation of linseed oil in the Summer of 1946. "The result of this cut," said the secretary of the Export Group, "was to reduce by 75 per cent the volume and value of the trade we were doing in the first post-war year, and which, in turn, was approximately half the value of our pre-war trade. This restriction in raw materials to the export side of the industry at the present time is particularly unfortunate, as British manufacturers were confidently looking forward at the end of the war to extending all markets and capturing new ones. With this purpose in view many directors and other executives of exporting houses have made extensive journeys abroad, and have returned only to find that they are unable to execute orders recently secured. As a result, the goodwill which has been enjoyed for many years in overseas markets has been jeopardised."

A New Threat

"There is a strong likelihood that if Britain cannot supply paints in the near future she will lose an immense amount of export trade to local competition in many of her former markets. The Argentine, for instance, has plenty of money to develop her own paint industry, and, still more important, she is perhaps the world's largest producer of linseed, much of which she is crushing locally. Her technique in high-grade paints and varnishes is in no sense comparable to that of the U.K. paint industry, but many of the goods she produces will be satisfactory for her local demands."

The U.K. paint industry has, during the last 100 years, trained and employed the best types of overseas agents and representatives who, through dealing in products of undoubted quality, have been able to give excellent servicing arrangements to their customers. Now, with no British goods to sell, they must—in order to earn a living—offer their services either to local manufacturers or to foreign competitors who are very anxious to employ them, but may stipulate as a condition of employment that when Britain is in a better position than at present to ship large quantities of goods, these men must not return to the employment of U.K. paint firms. Once this valuable network of overseas agents and representatives is lost to the U.K. exporter, it will be well-nigh impossible to re-establish an export trade in paints and varnishes.

"Paints and varnishes," said the secretary of the Export Group, "are an ideal type of export, as they earn a very good profit for British labour and capital, and pay high shipping rates. They were—and are—the best of their kind, the result of years of patient and highly-skilled research. Unless the U.K. paint and varnish industry can be assured by the British Government of a more generous allocation of raw materials for paint and varnish exports in the immediate future, it will lose permanently this very valuable trade and the excellent goodwill that has accompanied it."

Anti-Corrosive Materials

Wide Use of Plastics of the Vinidur and Oppanol Type

ALTHOUGH German plastics have figured rather frequently of late in the technical press, largely on the basis of several British and American intelligence reports, little has so far been said about the increasing use of the poly-vinyl-chloride (Vinidur) and polyisobutylene (Oppanol) groups, especially as anti-corrosives in a wide range of applications.

The former, Vinidur group, is probably the better known of the two, and finds a place in most modern books on plastics. For example, H. Barron in "Modern Plastics," 1946, says that, in Germany, various forms of straight poly-vinyl-chloride under names such as Astralon, Gutta-syn, Vinidur, etc., are used for covering cable, making tubes for numerous industrial uses, transparent sheets, etc. (Astralon is the principal transparent form). This author adds that Vinidur is the material most widely used for anti-corrosive purposes and for replacing rubber and metals. It has a specific gravity of 1.38 and a comparatively low softening point, 80° C. It is non-inflammable, odourless and tasteless; its tensile strength is 600 kg/cm², and the bending strength is more than 150 kg./cm². Up to 40° it is resistant to water, alkalies, mineral and some other acids, but not to aromatic hydrocarbons (benzene, toluene), ether, esters, ketones, and several chlorinated hydrocarbons.

In the field of co-polymers the Germans have prepared vinyl chloride and acrylic ester derivatives, the principal being Mipolam. This, indeed, as well as the Vinidur and Oppanol groups, is largely a development of one or more of the well-known I.G. Igelits introduced several years ago.

Comprehensive Survey

Any gaps there may have been in our knowledge of these products have now been abundantly filled by a comparatively new book edited by Dr. Walter Kranich and published by J. F. Lehmanns Verlag, of Munich and Berlin, in 1943. This is "Materials for Corrosion Protection," and is a handbook for Vinidur and Oppanol. In over 400 pages, well illustrated, the book gives a comprehensive survey of the production, properties, and uses of these two groups and some related products, with special reference to anti-corrosive applications and war-time uses—which were many.

The original Igelits (PCU and MP), together with Oppanol B200, have been developed in various directions and now comprise groups which may be roughly classified as (1) Vinidur products, (2) Astralon products, (3) Soft Igelit products, and (4) Oppanol products. The trade name Igelit is retained for a member of the first group, which also includes other trade names which may or may not be registered trade marks, such as Decelith, Mipolam, etc. The Vinidur group is manufactured in a great variety of forms, chiefly tube, rod, sheet, and foil (for linings and textiles). The Astralon group is derived from the Igelit MP (mixed polymerisate), and includes special purpose products in virtue of their transparency and non-colouring under heat treatment. The soft Igelit group is derived from the original Igelit PCU, by addition of suitable softening agents, for use as soft rubber substitutes and other purposes. The various softening agents added to either Igelit paste or powder include T.C.P. (tricresyl-phosphate)-G, Mesamoll, Palatinol AG, HS, and K, and for low temperature work Palatinol F, KF, and Elaol I. The Oppanol group comprises chiefly Oppanol-O, Oppanol-ORG, Oppanol-OG, and Dynagen, prepared from the original Oppanol-B200 (polymerised isobutylene).

Further Details

In Part 3 of the book, W. Buchmann, of Bitterfeld, treats in considerable detail of the molecular structure and formation of these various products—except the fourth group, which is left to A. Schwarz and W. Daniell. Dr. Kranich adds an elaborate table of some thirteen pages giving a considerable list of chemicals, chemical pre parations, both gaseous and liquid, against which these various plastics are more or less resistant at specific temperatures and under varying concentrations.

The fourth section is devoted to manufactured products and copiously illustrates those operations which are "chip-raising," i.e., those which involve loss of material as chippings, or dust, such as sawing, boring, lapping, etc., and those which do not involve loss of material, such as pressings and stampings. Various methods of joining are included.

The section on industrial and scientific applications is of considerable interest, and also copiously illustrated. The Vinidur group in particular, owing to mechanical strength and stability against corrosive or other aggressive action, has been put to a remarkable number of varied uses, e.g., in chemical plant for pipe and conduit systems and for external cladding or internal lining of apparatus; it frequently replaces metal altogether where mechanical strains are not too onerous. Examples of these various uses are taken from many industries.

including the manufacture of artificial silk, hydrochloric acid, etc., and relevant German standard specifications (D.I.N), governing these industrial applications of Vinidur, are frequently cited. Owing to the fact that it is odourless, tasteless, and physiologically inert, this material is particularly well suited for packaging, *e.g.*, for lining food containers.

Special attention is devoted to the best methods of lining. The Vinidur group cannot be used in solution as varnish or lacquer, as they are insoluble in the usual media; and they must therefore be applied as a coating film by means of adhesive. The thickness varies according to purpose intended, but usually should not exceed 1 mm., both on the ground of economy and to avoid risk of ripple or wave formation, or other irregularities of surface which might encourage occlusion of gases or other impurities and initiate corrosion. The temperatures to which the lining is exposed should not normally go beyond 50° C., although short temporary exposure to temperatures somewhat higher can often be tolerated without ill effect. Low temperature limits are also specified, and are usually in the neighbourhood of 0° C. For higher extremes of temperature the Vinidur lining may in some cases be considerably thicker, up to 5 mm.

Although riveted vessels can be lined if special provision is made to cover the rivet heads in such a way that they do not interfere with close and smooth adhesion, yet welded work is much more suitable. The surface to be lined must be carefully prepared, especially in regard to cleanliness and suitable roughing—to increase adhesion. This latter is best secured by sand-blasting—in the case of iron vessels, and very often also with copper or aluminium. The surface is then coated with a Zincate solution (30 per cent soda lye, 10 per cent zinc oxide, and 60 per cent water). A suitable adhesive, namely solution PC 10, is described, together with its mode of application. It must have low viscosity in order to penetrate deeply into the pores of the metal. Several coatings of adhesive may be required, and generally the amount used is 1.3-1.5 kg./m². In order to eliminate any residual gases these must be thoroughly driven off by heating the surface up to 140° C. before applying the Vinidur lining. This latter should also have a coating of adhesive, of slightly different composition, namely PCA 20, and likewise must be thoroughly cleaned. Detailed instructions are given for applying the lining, not only to metal, but also wood and concrete vessels. Various methods of test are described.

Other sections of the book deal with the use of these products in the electrical industries.

Water Softening Plant

A New Development

ONE of the difficulties with the ordinary continuous flow lime and soda ash softening plant is the slowness of precipitation of the calcium carbonate, and particularly of magnesium (as hydrate), a most objectionable constituent. Thus lime and soda ash plants should give at least three hours' setting, and in practice 4-5 hours is sometimes required. The slowness of precipitation throws much extra work on the filters, which therefore have to be cleaned at frequent intervals, thus causing waste of time and increase in net operating cost. Further, in order to obtain a treated water of maximum softness it is necessary in many cases to use an appreciable excess of reagent, largely due to the slowness in completing the chemical reactions.

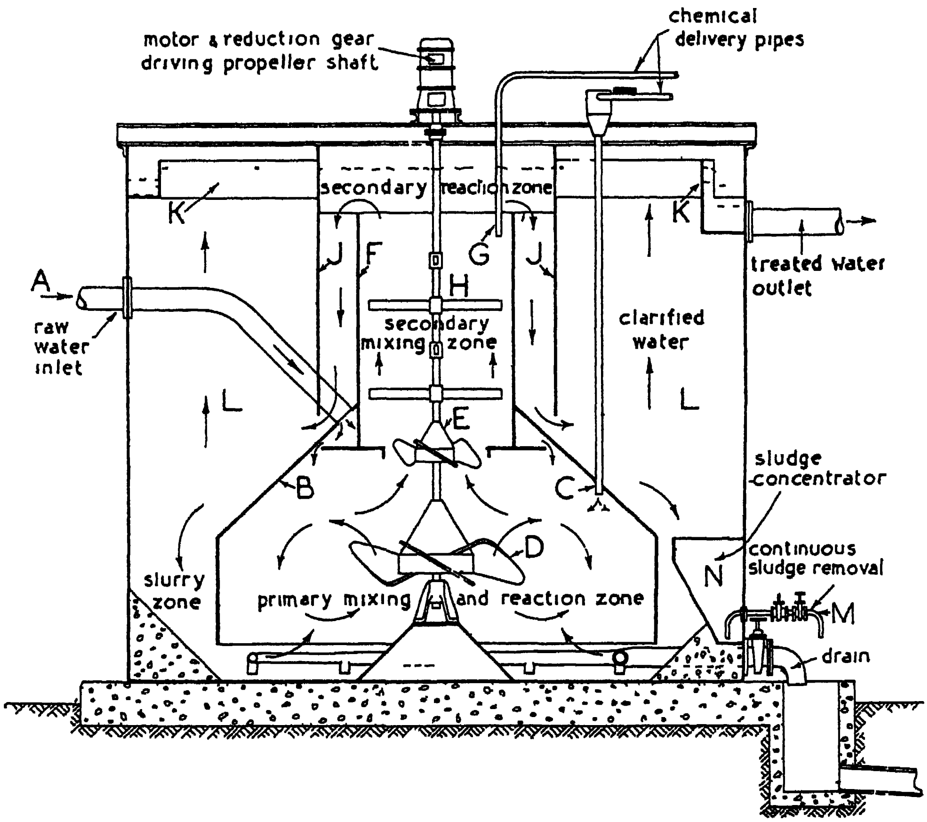
In general, two methods can be adopted to overcome these difficulties. The first is the addition of alum to the water after mixing with the reagent, so producing coagulation and much more rapid separation of the magnesium precipitate, which, in its initial stages, is in the colloidal condition, thus increasing the difficulty. The second method is known as "seeding;" a solution of some substance in water may be in the super-saturated condition, that is in a condition when crystals should separate out but do not do so for some not very clear reason. This separation of crystals from a supersaturated condition can be helped, however, by various methods, including mechanical agitation or shaking, and especially by the addition of a crystal of the substance, known as a "seed crystal," since it rapidly causes normal separation of crystals.

Calcium carbonate and magnesium hydrate sludge already formed in a softening plant have this "seed" effect upon the water under treatment, causing much more rapid gravity separation of the sludge and reducing the work thrown upon the filters. Ordinary softening plants are so operated to maintain a bed of sludge at the bottom to give this effect, which is somewhat limited, however, by lack of effective contact. Accordingly, much interest attaches to a new lime and soda ash softening plant, the "Accelator," placed on the market by the Paterson Engineering Co., Ltd., of London. The basic principle of this plant consists of the coagulant action and thorough mixing by

mechanical means of the already precipitated sludge with the softening reagent which results in a greatly increased seed effect

In general, the new plant consists of a vertical and relatively wide diameter main outer steel plate cylinder containing an inner reaction portion formed also of steel plate. The raw water enters by an inlet pipe at the side of the main cylinder and passes to what is known as the agitator hood, a circular closed chamber of wide diameter in the lower half of the main cylinder, with a top hood or cover. The upper portion or extension of this agitator is a vertical jacketed cylinder known as the secondary mixing zone down the centre of which is a vertical paddle shaft driven by a small electric motor. The shaft is provided with agitators of the propeller type, which give a violent agitation.

The chemical reagents (lime and soda ash) enter by a pipe into the top portion of the agitator hood, and the agitator gives an instantaneous and intimate mixing of the raw water with reagents and the slurry which is forced up into the upper secondary mixing zone by the propeller agitator. At the top of the secondary mixing zone, coagulant solution (alum) is added continuously, and a more or less gentle agitation is given by the simple agitators of the bar or paddle type operating in conjunction with baffles. The whole volume of water travels up from the agitator hood through the secondary zone and flows over at the top



Vertical section of the "Accelator" water softening plant.

A	Raw water inlet	H	Bar agitators and baffles
B	Agitator hood	J	Outer downcomer tube
C	Reagent entry point	K	Clear water discharge
D	Paddle agitator	L	Level between sludge level and clear water
E	Circulating propellers	M	Concentrated sludge discharge
F	Centre tube	N	Concentrator trough
G	Coagulant entry pipe		

of the latter and down through an outer jacket into the body of water in the main cylinder, the lower half of which constitutes the sludge settlement zone.

The pure, clarified water passes out continuously from the top of the plant. The sludge is removed continuously from the bottom of the plant by a "concentrator discharge trough," the inlet to which is about one-third of the height of the main cylinder, thus removing only the finer and lighter portions of the sludge, which have the least seeding effect. The lime cream and the soda ash solution are supplied separately to the water; there is no need to mix them first, as with ordinary lime and soda ash plant, because the resulting seeding effect of the calcium carbonate thereby formed is not required, since it is already given in most effective fashion within the plant from the sludge already present.

The net result of this "Accelator" design, according to the designers, is greatly increased efficiency, giving the maximum degree of softening, combined with extremely low excess of alkalinity, and most effective sludge separation, resulting both in a saving in chemicals and a great reduction in the washing of filtering material. Total hardness in most cases can be reduced to less than 2.5 parts per 100,000 (as calcium carbonate), with no appreciable excess of lime and soda ash reagent, combined with an extremely low alkalinity down to say 5.5 parts (as calcium carbonate) per 1,000,000 by the standard phenolphthalein alkalinity test.

Fuel Research

Training at Birmingham University

COAL utilisation and fuel technology are to receive the special attention of the newly-formed Department of Chemical Engineering at Birmingham University, according to a statement made last week by the Vice-Chancellor, Dr. Raymond Priestley. He was addressing about 130 executives from gas and allied industries who were on a visit of inspection under the auspices of the Midland Gas and Allied Industries University Collaboration Committee, and he added that if the department is to fulfil the purpose for which it was started, industrial support would be necessary for the appeal for the extension of the department.

Dr. Priestley declared that the training of and research by chemical engineers was regarded as vital to the production of high-quality goods for export. This country, he said, had exhausted, or nearly exhausted, the easiest-won of the coal and the highest grade of the iron ores which were its principal original raw material assets in industrial competition. "We have small home markets compared with our greatest competitors," he went on, "and the answers to these problems are to use our remaining resources with the greatest possible economy and ingenuity, and to produce for export goods of the highest quality. That is, we must capitalise our best brains, our national skill and the faculty for the co-ordination of hand and brain in which as a people we are endowed, I believe beyond most others, and it is in these two fields that this University plans to help.

Apart from those problems, Dr. Priestley said, there was the fundamental trouble of the nation being today one of overtired people. The industrial system was grievously ill, and the chief symptom of the disease was, apparently, an insufficient output per man hour. He hoped the University's new department of Engineering Production would help to solve that problem.

Silicon Iron Pipes

New British Standards

A NEW British standard, "Acid-Resisting Silicon Iron Pipes and Pipe Fittings" (B.S. No. 1333 : 1946), deals with the dimensions of high silicon pipes and pipe fittings from 1 in. to 12 in. nominal bore which are extensively used in chemical plant and where excessive corrosion is inevitable or anticipated. The minimum silicon content to give maximum corrosion-resisting properties is generally agreed to be 14.25 per cent.

Silicon iron is more brittle than ordinary cast iron and, in consequence, requires greater care and precaution in handling and transport. It is more difficult to cast and is more liable to porosity and distortion than ordinary cast iron. There is particular difficulty in casting silicon iron pipes with integral flanges and, in this standard, flanged pipes are specified with 45° cone ends for assembly by halved loose coupling flanges of ordinary cast iron impinging upon the 45° cone ends of the pipe.

The standard also deals with spigot and socket pipes, the spigots of which are generally similar to the end of the cone end pipes, thus allowing inter-connection between cone end and spigot and socket pipes. The sockets of the spigot and socket pipes will also accept the plain spigots of chemical stoneware pipes of the same nominal bore so allowing interconnection between silicon iron socket and stoneware spigot. The fittings included comprise elbows, bends, tees and crosses for both flanged and spigot and socket pipes.

Copies of the standard can be obtained from the British Standards Institution, 28 Victoria Street, London, S.W.1 (Price 2s.).

Sulphuric Acid Production

Quarterly Statistical Summary

THE National Sulphuric Acid Association, Ltd., 166 Piccadilly, London, W.1, has issued details relating to the production and consumption of sulphuric acid, etc., in the United Kingdom and Eire for the third quarter of 1946 and these are summarised in the following tables:

TABLE I.—SULPHURIC ACID AND OLEUM
(*Tons of* 100 *per cent* H_2SO_4)

	Chamber only	*Contact only*	*Chamber and Contact*
Stock, July 1, 1946 ...	34,935	30,821	65,756
Production	167,208	162,355	329,563
Receipts	39,664	25,157	64,821
Oleum feed	—	2,089	2,089
Adjustments	−218	−49	−267
Use	98,902	72,246	171,148
Despatches	108,172	124,540	232,712
Stock, Sept. 30, 1946	34,515	23,587	58,102
Total capacity represented	220,290	189,550	409,840
Percentage production	75.9	85.7	80.4

TABLE II.—RAW MATERIALS
(*Tons*)

	*Pyrites**	*Spent Oxide*	*Sulphur and* H_2S	*Zinc Concentrates*
Stock, July 1, 1946	83,412	139,128	45,776	64,447
Receipts	61,764	51,992	60,229	30,357
Adjustments ...	−75	−634	−45	+664
Use	73,366	46,845	49,054	38,285
Despatches ...	571 28†	4,656 226†	—	8
Stock, Sept. 30, 1946	71,136	138,759	56,906	57,175

* "Receipts" and "Use" include anhydrite "converted" to pyrites.
† Used at works for purposes other than sulphuric acid manufacture.
Note.—The above figures exclude Government plants except in those cases where Government plants are producing acid for trade purposes.

TABLE III.—CONSUMPTION OF SULPHURIC ACID AND OLEUM
(*July* 1 *to September* 30, 1946)

Trade Uses		*Tons 100%* H_2SO_4
60	Accumulators	2,097
61	Agricultural purposes	4,887
63	Bichromate and chromic acid ...	2,098
64*	Borax and boracic acid (*see* 105)	
65	Bromine	3,072
66*	Chlorsulphonic acid (*see* 105)	
67	Clays (Fuller's earth, etc.) ...	1,740
68	Copper pickling	582
69	Dealers	3,317
70	Drugs and fine chemicals ...	2,547
71	Dyestuffs and intermediates ...	14,667
72	Explosives	2,423
73	Export	664
74*	Formic acid (*see* 105)	
75	Glue, gelatine and size	96
76	Hydrochloric acid	13,731
77	Hydrofluoric acid	670
78	Iron pickling (including tin plate)	17,996
79	Leather	1,140
81	Metal extraction	190
82	Oil (mineral) refining	8,372
83	Oil (vegetable) refining	1,448
84	Oxalic, tartaric and citric acids ...	1,905
85 & 80	Paint and lithopone	16,090
86	Paper, etc.	766
87		
88	Phosphates (industrial)	1,119
89	Plastics, not otherwise classified...	4,675
90	Rare earths	2,053
91	Rayon and transparent paper ...	24,835
92	Sewage	2,078
93	Soap and glycerine	536
94	Sugar refining	118
95*	Sulphate of alumina (*see* 105)	
96	Sulphate of ammonia	53,579
97	Sulphate of barium	956
98	Sulphate of copper	5,293
99	Sulphate of magnesium	2,333
100	Sulphate of Zinc	512
101	Superphosphates	104,309
102 & 62	Tar and benzole	3,350
103	Textile uses	4,539
105	Unclassified—*Uses known ...	18,415
	Uses unknown ...	8,803
	TOTAL	338,001

I.C.I. Expansion

Grangemouth Scheme Hindered

DEVELOPMENT of the Grangemouth scheme of I.C.I., Ltd., at a cost of £3,000,000, is understood to be hindered by the question of an adequate water supply.

It is stated that the town has already given guarantees that it will supply I.C.I. with the required volume of water, but has so far been prevented from developing its water resources pending a decision by the Department of Health for Scotland, which has a long-term regional water scheme for central Scotland. The long-term scheme would probably require from 15 to 20 years to develop, whereas the immediate requirement is for a local expansion in from 12 to 18 months.

Authority has been sought to allow an increase in the local area of supply at an early date, failing which it is feared that the I.C.I. expansion scheme might be transferred to Huddersfield.

It may not be generally known that Charles Carr, Ltd., and the Non-Ferreous Casting Co. (Birmingham), Ltd., are under one direction. Their activities are described in two new booklets, *The House of Carr for Castings* and *Chill Cast Phosphor Bronze Rods and Tubes*, which may be obtained from Woodlands, Smethwick.

The Chemical Society

Faraday Lecture

AS briefly announced in THE CHEMICAL AGE last week, Sir Robert Robinson, D.Sc., LL.D., Pres.R.S., has accepted the invitation of the Council of the Chemical Society to deliver the Faraday lecture during the Society's centenary celebrations next July.

The Faraday Lectureship was founded in 1867 to commemorate Michael Faraday, who was elected a Fellow of the Society in 1842 and was one of its vice-presidents. Normally, the lecture is delivered every three years; and the lectureship is the highest honour which the Chemical Society can offer. The list of names of previous Faraday lecturers is an imposing array of the great men of chemical science: Dumas, Cannizzaro, von Hofmann, Wurtz, Helmholtz, Mendeleeff, Lord Rayleigh, Ostwald, Fischer, Richards, Arrhenius, Millikan, Willstätter, Bohr, Debye, and Lord Rutherford.

The lecture, which will be delivered in the Central Hall, Westminster, on July 16, 1947, will form the principal scientific event of the centenary celebrations. It is especially fitting that Sir Robert Robinson, a past-president of the Society, should be chosen to deliver the lecture, for, had the centenary celebrations taken place in 1941, the actual hundredth anniversary of the foundation of the Chemical Society, he would have presided over them. Moreover, Sir Robert's work on electronic influences in organic chemistry not only has a link with Faraday's discoveries, but forms an outstanding British contribution which the Chemical Society may be justly proud to place before the distinguished foreign guests and others attending the centenary celebrations.

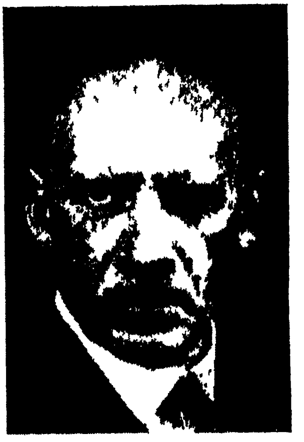
The Liversidge Lecture

The eleventh Liversidge Lecture of the Chemical Society will be delivered by Professor Harold C. Urey at the Royal Institution, Albemarle Street, London, W.1, on December 18, at 7.30 p.m.

Professor Urey, who is coming from the United States at the society's special invitation, is best known as the discoverer of heavy hydrogen. A 1934 Nobel Prizeman, he has been identified for many years with the isolation of isotopes and has taken a notable part in this connection in the development of the atomic bomb. In 1940 he was awarded the Davy Medal of the Royal Society. He is Professor at the Institute of Nuclear Studies in the University of Chicago.

The title of Professor Urey's lecture is "Some Problems in the Separation of Isotopes" and it is in keeping with the tradition of the Liversidge Lectureship which deals with new knowledge in general, physical, and inorganic chemistry.

The first lecture of the series was delivered



Sir Robert Robinson.

in 1928 by Professor F. G. Donnan; and the list of lecturers includes Herbert Freundlich, C. N. Hinshelwood, N. V. Sidgwick, and F. W. Aston.

Andersonian Chemical Society

Diamond Jubilee Celebration

ONE of the oldest among students' chemical societies, the Andersonian Chemical Society at Glasgow Royal Technical College, has a record of sixty years' continuous operation. It was founded in 1886, so this year marks its diamond jubilee.

So notable an occasion deserved recognition, and a modest but interesting programme has been arranged to take place at the Society's premises next Friday, November 22. Dr. D. S. Anderson, B.Sc., A.R.T.C., M.I.Mech.E., Director of the Royal Technical College, will open the proceedings at 2.30 p.m. An address will follow by Professor J. W. Cook, D.Sc., Ph.D., F.R.I.C., F.R.S., Regius Professor of Chemistry, Glasgow University. Thereafter, until 5.30 p.m., the chemical laboratories will be open for inspection.

The Andersonian Chemical Society took its name from the Andersonian University, founded in 1796 under the will of John Anderson, M.A., F.R.S. (1726-1796), Professor of Natural Philosophy in Glasgow University. This institution, later to become the Glasgow and West of Scotland Technical College, and now the Royal Technical College, provided opportunities for "liberal and scientific education of all classes."

Parliamentary Topics

Fuel Economy Conference

IN the House of Commons last week, Mr Janner asked the Minister of Fuel whether he would consider issuing a White Paper setting out the principal lessons learned at the recent Fuel Economy Conference organised by his Department, together with an indication of what action was to be taken to implement such of the lessons as had been approved by him.

Mr. Shinwell replied that he had already arranged for the proceedings of the conference to be published. All the papers and recommendations were being exhaustively studied by the Fuel Efficiency Committee, as well as by his department, and would be published or publicised in due course in the manner best designed to secure practical results. The action to be taken on the recommendations would necessarily be continuing action, much of it over a long period

Fuel Oil Subsidy

Mr. Shinwell, in reply to Sir Patrick Hannon, stated that details of the fuel oil subsidy scheme were published in the daily and technical press on or about October 1, the date from which the subsidy became payable. At the same time, it was announced that the normal peacetime system of zonal pricing of black oils, and of the granting of quantity rebates to all consumers buying more than 100 tons of oil a year was being reintroduced.

Sir P. Hannon: Does that mean that the functions of the Petroleum Board are now in the hands of the right hon. gentleman?

Mr. Shinwell: I would not go so far as that, but there is very close liaison between the two parties.

Linseed Oil

The Minister of Food, asked by Mr. Bossom whether he had given instructions that special efforts should be made by the British representatives in the Argentine to endeavour to make available more linseed oil, replied in the affirmative and added that 27,000 tons of linseed oil were now being shipped to this country. Answering a further question by Mr. Nutting, Mr. Strachey said the first shipment reached London last week. A second ship was now loading; and sufficient freight space had been booked to cover the remainder of the purchase.

Industrial Diseases

The Lord President of the Council, asked by Mr. Janner whether he would give some indication of the research work now permitted on various industrial diseases by the Medical Research Council, said the Medical Research Council maintained three departments for that purpose as part of their own staff organisation, and also supported research work elsewhere by means of temporary grants. The subjects under investigation were of the following general kinds: disorders caused by inhalation of dusts, by exposure to chemical substances, or by other special conditions of work; increased liability in certain occupations to diseases not specifically industrial; and occupational conditions which, without causing definite disease, affected the health, comfort and efficiency of workers.

Tanganyika Ground Nuts

Mr. Dodds-Parker asked the Minister of Food what is the earliest date at which it is estimated that a crop will be forthcoming under the ground nut scheme for Tanganyika; to what extent the scheme is dependent on the provision of agricultural machinery on a large scale; and whether, in view of the need for increasing world supplies of fats, he will give an assurance that the highest priority will be given to providing machinery.

Mr. Strachey replied that the earliest date at which a crop could be harvested would be April and May, 1948, and he hoped that the first supplies may be forthcoming by then. The scheme was, however, entirely dependent upon the availability of machinery for clearing the bush, agricultural machinery and other special mechanical equipment. Every effort would be made to obtain the equipment.

Plastic Material

Mr. J. Morrison asked the President of the Board of Trade why it was not possible to purchase plastic mackintoshes without coupons, while the same plastic material could be purchased by the yard without coupons.

Mr. Belcher said the conversion of plastic material to clothing involved the use of making up facilities, and coupons were reasonably charged. He should not wish to add plastic material to the ration in view of its various household uses.

A useful "Valve and Service Guide" has been issued by the Mullard Wireless Service Co., Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

Philips Industrial (Philips Lamps, Ltd.) have produced a new type in their range of magnetic filters in which the method of cleaning the filter has been radically altered to meet the special requirements of certain operations, such as grinding, where ferrous contamination is very heavy and quick and easy cleaning is of first importance.

Personal Notes

SIR EDWARD HOARE, Bt., has joined the board of directors of New Metals & Chemicals, Ltd.

MR S. W. WEST, of the X-ray Division, Philips Lamps, Ltd., is to join the North American Philips Company as technical manager, X-ray Division, in the New York Office.

DR. H. W. KEENAN, president of the Oil and Colour Chemists' Association, has succeeded the late Mr. Douglas Wait as examiner in the paint, colour and varnish examinations of the City and Guilds of London Institute.

MR. NORMAN SHELDON, A.R.C.S., F.R.I.C., vice-president of the British Association of Chemists, has been elected as a Conservative member of Twickenham Borough Council. He secured a large majority over his Labour and Liberal opponents.

MR. A. G. JEACOCK, who has retired from the position of chief analyst at the Pilkington-Sullivan Works of I.C.I. (General Chemicals Division), has been engaged in the chemical trade for nearly 48 years, the last 35 years being spent in Widnes. He is a former chairman of Runcorn Urban District Council, and a former captain of Runcorn Golf Club.

DR T. W. J. TAYLOR has been appointed principal of the new University College of the West Indies. For many years after getting a "first" in chemistry at Oxford he was tutor to Brasenose chemists and demonstrated in organic chemistry at the Dyson-Perrins Laboratory. After a short period of war service in the Middle East, he went to Washington in January, 1943, as secretary (and later director) of the British Commonwealth Scientific Office. He became scientific adviser to the Supreme Allied Commander, S.E. Area, in March, 1944, and returned to Oxford in October, 1945. He was awarded the C.B.E. for his war services.

Obituary

MR. J. E. HEWLETT, whose death has occurred at the age of 61, was deputy chairman of the Anchor Chemical Co., Ltd., Clayton, and a director of the United Oil and National Gas Products Corporation, Ltd. An alderman of the city of Manchester, he was also a J.P. and a prominent Freemason.

We regret to announce the death at Teddington, on November 4, after a long illness, of MRS. ISABELLA KELL SHELDON, wife of Mr. Norman Sheldon, vice-president of the British Association of Chemists, and take this opportunity of extending our sincere sympathy to Mr. Sheldon.

A Chemical Centenary

Manchester Company's Progress

PETER SPENCE & SONS, LTD., of Manchester and Widnes, celebrates its centenary this month. The company began the manufacture of alum by a new and revolutionary process invented by the founder of the firm, the late Peter Spence, in 1846. Until then, the manufacture of alum had not changed materially since the days of Queen Elizabeth.

From this basis the company has developed its processes and today manufactures, largely from indigenous materials, a range of products which find their outlets in utility services and industrial undertakings throughout the world. The paper trade in particular has for many years been served by the company, which has established a wide connection in that branch of industry. Starting, in its early days, with a small site in Manchester, the company transferred its activities during its progressive history to larger and more modern works in various parts of the country, and today manufactures its products at Widnes, Goole, Bristol and Bushey.

The company's policy has always been to keep to the forefront of current thought, not only in the technical sense, but also in employee relationships and amenities. It is interesting to note the unique continuity of family association in that throughout its existence the company has been directed and guided by a member of the Spence family. Notable progress has been made during recent years and the company's war record is one of which everyone is justly proud.

German Technical Reports

Latest Publications

A FURTHER selection of recent technical reports from Intelligence Committees in Germany is given below. Copies may be obtained from H.M. Stationery Office at the prices quoted.

BIOS 458. (Appendix). Report on the ceramic industry in Germany (4s.).

BIOS 538. Report on German patent records (1s. 6d.).

BIOS 610. German tinplate industry (2s. 6d.).

BIOS 649. Piel and Adey gravity die-casting process for non-ferrous metals (1s.)

BIOS 685. German ingot moulds for the casting of steel ingots (11s.).

BIOS 704. Mechanical foam liquid and equipment: Fire extinguishing (1s. 6d.).

BIOS 751. *I.G. Hoechst*: Pilot plant manufacture of vinylacetylene (6d.).

BIOS 789. *Krupp A.G., Essen, and Deutsche Edelstahlwerke A.G., Krefeld*: Special steels: Notes on practice (5s.).

General News—From Week to Week

The telephone number of the Chemical Council has been changed to REGent 1675-6.

The Ramsay Chemical Dinner, which is being held at the Marlborough House, Glasgow, on December 6, will be supported by local sections of numerous chemical and allied organisations.

Small industrial firms have received loans of £5,000,000 from the Government-sponsored Industrial and Commercial Finance Corporation, Ltd., stated Lord Piercy, chairman of the corporation, last week.

The latest publication of the National Home Safety Committee, "Hints on the Safe Use of Electricity," sets out the "Do's" and "Don't's" which every electricity consumer should know.

The opinion that the U.S.A. is still "a good long way" behind Britain in the organisation of scientific endeavour was recently expressed by Dr. Alexander King, Director of the British Commonwealth Scientific Office in Washington.

Containing 200,000 units of penicillin, ten phials were stolen from the premises of a chemist at Kirkintilloch, Scotland, but most of them were subsequently recovered by the police, who found them in the possession of schoolboys.

The Industrial Division of the Royal Society for the Prevention of Accidents is now installed in its new offices at 131, Sloane Street, London, S.W.1, but correspondence should still be addressed to Terminal House, 52, Grosvenor Gardens, London, S.W.1, which remains the Society's headquarters.

The Cement Makers' Federation has announced that owing to increasing demands it is able to make a reduction of 2s. per ton in the price of Portland and rapid hardening cement in Great Britain and Northern Ireland. The reduction is retrospective from November 1.

Manufacturing firms which are new to exporting and which have packing or packaging problems are invited to attend a one-day conference which is to be held on November 29 at 23, Knightsbridge, London, S.W.3. Details are obtainable from the Council of Industrial Design, Tilbury House, Petty France, London, S.W.1.

The slow upward movement in wholesale prices since last February, amounting in all to just over 3 per cent, as measured by the Board of Trade index number, was continued in October, average prices rising by a further 0.1 per cent, compared with September. In the "Chemicals and Oils" group, embracing 15 items, the index number of 105.1 showed a decrease of 0.8 per cent compared with September.

Among the stands at the British Export Exhibition, opened at the London Exhibition Centre, New Coventry Street, W.1, this week, is one featuring "Fertosan" compost accelerator. The exhibition, which has been organised by Leon Goodman Displays, Ltd., is open daily (excepting Sundays) until November 23 from 9.30-6 (Saturdays 9.30-1).

D.T.D. Specification No. 678, "Methyl Bromide," is now obtainable from H.M. Stationery Office (price 6d.). Amendment List No. 1 has been issued to D.T.D. Specification No. 133C, "Aluminium Alloy Sand or Die Castings (Heat Treated)" (price 1d.) and No. 363A, "Aluminium Alloy Extended Bars and Sections (Bars and Extended Sections up to 6 in. diameter or width across flats)" has been reprinted to incorporate Amendment List No. 1 (price 1s.).

Atomic energy will not be ready to take its place in engineering practice for another ten years, in the opinion of Mr. W. D. Oliphant, B.Sc., A.M.I.E.E., F.Inst.P., F.R.S.E., of the research staff of Ferranti, Ltd., speaking recently on the subject of "Nuclear Energy" at a meeting of the Scottish Students' Section of the Institution of Electrical Engineers. He expressed the belief that atomic energy would be most applicable in large power installations, but could not at present visualise its being practicable in small devices.

The Institute of Fuel's headquarters will shortly be transferred from their war-time address at 30, Bramham Gardens, London, S.W.5, to their own premises at 18, Devonshire Street, W.1, where, for the first time in the Institute's history, a members' room and library will be available, as well as a council chamber and committee room, for which there was no accommodation at the war-time offices. A Building Fund Appeal Committee has been appointed to raise £25,000 for the purchase and equipment of the new premises, which have been secured on a long lease.

Following the reduction in price of the Government-owned stock of mercury metal (from £30 to £25 per bottle of 76 lb.), the Board of Trade have decided that the import of mercury shall revert to private trade as from November 7, 1946. Supplies of mercury may still be obtained from the Government store until such time as users are able to make their own buying arrangements. It is hoped such arrangements will be made before December 31, 1946. Users intending to make direct imports should submit an import licence application to the Import Licensing Department, Board of Trade, 189, Regent Street, London, W.1.

Thirty thousand operative dyers, bleachers and finishers will receive advances in wages as the result of an agreement between the Allied Association of Bleachers, Dyers, Printers and Finishers and the National Union of Dyers, Bleachers and Textile Workers. The working week will be 45 hours, instead of 48. Male adult time workers will receive an increase of 3s. on a 45-hour week, and adult females 2s. 8d., with proportionate increases for juveniles.

Foreign News

The world's first continuous seamless pipe mill, it is reported, is to be erected in Ohio, U.S.A., by the National Tube Co.

A million-dollar plant for chemical specialities is to be built at West Toledo, Ohio, by the Du Pont Company.

Atomic power plant can be constructed to run at a cost only 26 per cent above that of one using coal, according to a report by American scientists.

A 4 to 5 year shortage of trained technical men, as a result of war-time demands on manpower, is shown in a survey of industry in the United States.

For the production of penicillin, construction of a plant at Stockholm, Sweden, is planned by Technical Enterprises, Inc., of New York.

Switzerland has removed restrictions on the purchase and holding of gold coins, under a decree published by the Federal Finance Excise Department.

With a total capacity of 20 tons daily, Bombay Province will have three caustic soda and chlorine plants under the Indian Government's decentralisation scheme.

The first international congress to be held by the South American Petroleum Institute, formed a few years ago, is to take place in Lima, in March.

An annual output of 250,000 tons of nitrate and fertiliser is planned by Fertiliser and Chemical Industries of Egypt, a company newly formed in Cairo with a capital of £4,000,000.

India's exports to Australia of drugs, chemicals and fertilisers have increased sevenfold in recent years, the total value in the twelve months 1944-5 being £42,358, whereas the figure for 1938-9 was only £6199.

With the object of evolving national standards in respect of structures, commodities, materials and operations and for promoting standardisation, quality control and simplification in industry and commerce, the Indian Government has announced the setting up of what is to be known as the Indian Standards Institution, with headquarters in New Delhi.

Protein concentrate which contains all the essential amino acids is claimed to have been developed by Frederick Stearns and Co. in the United States.

One of three American centres where research in nuclear physics is to be carried out, Camp Upton on Long Island has been selected for the projected new Northeast National Laboratory.

An institution of technology, complementary to the University, is to be established by New South Wales Government, the intention being that it shall be of national rather than State significance.

The Canadian Minister of Trade and Commerce, Mr. J. A. Mackinnon, has announced a plan to hold Canada's first International Trade Fair at Toronto Coliseum in the first two weeks of June, 1948.

Discovery of two new drugs for treatment of sleepy sickness is reported from New York. A new drug which acts against half-a-dozen types of infections is claimed to have been discovered by research workers of the American Parke, Davis & Co.

France's glue-producing capacity was unaffected by the war, it is reported; and expectation is that 70 per cent of its pre-war annual output of 5900 tons will be reached in 1946 and that by 1947 the pre-war level will have been recovered.

The Malayan Union Government has announced a reduction as from November 11 in the export duty on rubber to 2¾ cents per pound from 4 cents per pound. In Penang, which is the Union's free port, the excise duty on rubber has been reduced similarly to 2¾ cents.

The Italian Government has recently granted a concession for the exploration of petroleum deposits in Sicily to an American company, the McMillam Petroleum Corporation of New York. Drilling operations are to extend over a territory of about 13,000 hectares and it reported that work is to start at an early date.

In Italy a new company is to be formed, with an initial capital of 100,000,000 lire, to engage in the import and manufacture of special American pharmaceutical products. At the same time, the new enterprise will make available, to Italian pharmaceutical companies, details of scientific and technical progress in recent years in the American pharmaceutical industry.

Increased production, lowered costs and competitive conditions have brought the price of penicillin down in the U.S.A. to the record low level of 50 cents per vial of 100,000 units to hospitals and about 40 cents per vial to wholesalers. This compares with the price of 75 dollars per vial in January, 1944, shortly after penicillin was first made available for general use.

The Standard Oil Company of California is planning the construction of an oil refinery near Alexandria for the treatment of Arabian crude oil, according to a statement by the group's president, Mr. R. G. Follis, in which he also revealed that oil production in Saudi Arabia now totals roundly 9,000,000 tons a year and could easily be increased.

Turkey's five-year industrial plan includes construction of three chemical undertakings: At Kütahya, a nitrogen factory to produce 6000 tons of nitric acid and 30,000 tons of various nitrates annually; at Istanbul or near Izmit, a soda factory to produce 20,000 tons of carbonate of soda and 6000 tons of caustic soda annually; at Izmit a factory for sulphate of copper; and at Gemlik one for carbon disulphide.

Negotiations have been successfully completed, between the Government of Travancore State and representatives of mineral companies operating at Trivandrum, for the erection of a factory in Travancore. A representative of the Du Pont de Nemours group has also participated in the negotiations. Arrangements have also been made for the mining, processing and exporting of titanium containing sand.

Two fusions of Malayan rubber companies are stated to be under consideration. The Straits Rubber Company, having an issued capital of £787,500, is to merge with Batak Rabit Rubber Estate, issued capital £75,000. The second fusion involves the Bagan Serai, Glenshiel, and Merchiston companies, having combined issued capital of £288,000. Treasury permission has been obtained for the first scheme, but the second is still subject to sanction.

Forthcoming Events

November 18. Society of Chemical Industry (Plastics Group). Royal Institution, 21, Albemarle Street, London, W.1, London, 6.30 p.m. Mr. F. P. Dunn: "British Chemical Publications."

November 18. Society of Chemical Industry (London Section, jointly with Food Group). Royal Institution, Albemarle Street, London, W.1, 6.30 p.m. Mr. F. P. Dunn: "British Chemical Publications" (Jubilee Memorial Lecture).

November 19. Hull Chemical and Engineering Society. Church Institute, Albion Street, Hull, 7.30 p.m. Dr. L. Mullins: "X-rays in Industry."

November 19. Institution of Rubber Industry. Waldorf Hotel, London, W.C.2, 6.30 p.m. Mr. M. M. Heywood: "The Clean Handling of Black."

November 20. Society of Dyers and Colourists (Midlands Section). Midland Hotel, Derby, 7 p.m. Mr. C. C. Wilcock: "Preparing, Dyeing and Finishing of the New Fibres."

November 20. The Chemical Society (jointly with Dublin Section of R.I.C.). University College, Upper Merrion Street, Dublin, 7.30 p.m. Dr. T. G. Brady: "Biochemical Microtechnique."

November 20. Institution of the Rubber Industry (Leicester Section). College of Art and Technology, Leicester, 7.30 p.m. Mr. F. S. Roberts: "Rubber Compounding Ingredients."

November 21. The Chemical Society. Chemistry Lecture Theatre, The University, Sheffield, 6 p.m. Dr. C. H. Desch: "Chemistry in the Metallurgical Industries."

November 21. The Chemical Society, Society of Chemical Industry, Royal Institute of Chemistry. (Edinburgh and East of Scotland Sections). North British Station Hotel, Edinburgh, 7.30 p.m. Professor F. S. Spring, D.Sc.: "Some Developments in the General Methods of Organic Chemistry."

November 21. The Chemical Society. Burlington House, Piccadilly, London, W.1, 7.30 p.m. Mr. H. D. C. Waters, Mr. A. R. Caverhill and Mr. P. W. Robertson: "The kinetics of halogen addition to unsaturated compounds—XII" and "Iodine catalysts of chlorine and bromide addition to ethyl cinnamate."

November 21. The Chemical Society. Burlington House, Piccadilly, London, W.1, 7.30 p.m. Mr. A. Robertson and Mr. W. A. Waters: "Evidence for the Homolytic Bond Fission of 'Positive Halogen' Compounds."

November 22. Society of Chemical Industry. (Chemical Engineering Group). Geological Society's Rooms, Burlington House, Piccadilly, London, W.1, 5.30 p.m. Mr. H. B. Fergusson: "Welding of High-Pressure Vessels for the Chemical and Oil Refinery Industries."

November 22. Institute of Physics (Industrial Spectroscopic Group). Department of Applied Science, The University, Sheffield, 2.15 p.m. Mr. D. M. Smith: "The Spectographic Analysis of High-purity Materials."

Company News

The nominal capital of **Allied Paints and Chemicals, Ltd.**, Wharfedale Road, Tyseley, Birmingham, has been increased beyond the registered capital of £10,000 by £40,000, in £1 ordinary shares.

The nominal capital of **Southon Laboratories, Ltd.**, 88, Upper Richmond Road, Putney, S.W.15, has been increased beyond the registered capital of £100 by £24,900 in £1 ordinary shares.

New Companies Registered

Ingram and Parish, Ltd. (423,115).—Private company. Capital £5000 in £1 shares. Manufacturers of and dealers in chemicals, etc. Directors: Wm. F. Ingram; Albert C. Parish. Registered office 28, Museum Street, London, W.C.1.

Anglo Scottish (General Exports) Ltd. (24,687).—Private company. Capital £1000 in £1 shares. Merchants, exporters and importers of chemicals and chemical products, etc. Directors: W. G. Kerr; G. D. W. Organ. Registered office: 20, Renfield Street, Glasgow, C.2.

Charles Leatherbarrow, Ltd. (423,009).—Private company. Capital £10,000 in £1 shares. Manufacturers and processors of plastics, coal, coal products, chemicals, etc. Directors: Wm. C. Leatherbarrow; John E. I. Lyde. Registered office: 6, Stanley Street, Liverpool, 1.

Mono-Plastic Chemicals, Ltd. (423,134.—Private company. Capital £50,000 in ordinary shares of 1s. and 7 per cent participating cumulative preference shares of £1. Manufacturers of and dealers in chemicals, etc. Directors: Victor N. Scott; Albert A. Henly. Registered office: 19, Grosvenor Place, London, S.W.1.

Bioplastics, Ltd. (422,775).—Private company. Capital £50,000 in 1s. shares. Investigation, acquisition and development of inventions, processes, brevets d'invention, concessions and the like relating to scientific, chemical, metallurgical research, etc. Directors: Sir C. Courtney; R. Evans; J. Lecher. Registered office: 1, Cumberland House, Kensington Court, London, W.8.

Chemical and Allied Stocks and Shares

HOME and international political uncertainties have checked the recent strong upward movement in stock markets, business in most sections showing some contraction, while industrial shares reflected moderate profit-taking. British Funds eased, but later rallied. There were further gains among colliery shares, and iron and steels have been firm with moderate gains predominating; but home rails lost ground among other nationalisation groups, partly owing to the L.M.S. statement regarding shortages of materials and labour.

Chemical and kindred shares continued to reflect encouraging export trade news and indications of the progressive policy being followed by the industry. Imperial Chemical were good at 43s. 6d., B. Laporte 98s. 1½d., Fisons 58s. 3d., W. J. Bush 92s. 6d., and Greeff-Chemicals Holdings 5s. ordinary 12s. 7½d. British Drug Houses at 56s. 9d., lost part of their recent rise, but Stevenson & Howell showed firmness at 30s. 6d. following the interim dividend, and Morgan Crucible were good at 54s. 6d. with the 5½ per cent preference 30s. 9d., and the 5 per cent preference 29s. 9d. Paint shares lost ground owing to further news of the effect on output of raw material shortages, but share prices showed some recovery later, Lewis Berger being £6¼ on hopes of an increase in the forthcoming dividend. Goodlass Wall 10s. ordinary were 30s. 9d., and Wailes Dove 5s. ordinary 21s. 6d. United Molasses at 52s. 10½d., Turner & Newall at 85s. 9d. and Lever and Unilever 48s.xd. lost part of recent gains. Announcement of lower cement prices affected cement shares, Associated Cement losing ground at 66s. 6d. British Plaster Board were 32s. 9d. and in other directions, Dunlop Rubber eased to 51s. 6d. Despite hopes of an increase in the forthcoming interim dividend, the units of the Distillers at 134s. 6d. lost part of their recent rise. Tube Investments moved back to £6 3/16 on the dividend, the market apparently having been hopeful that last year's special payment would have been repeated; although it was recognised that it has been officially stated that the steel scarcity is affecting some of the group's activities.

Guest Keen were firm at 42s. 9d.xd, United Steel strengthened to 24s. 9d. on the results, T. W. Ward were good at 44s. 9d., and among collieries, Shipley moved up to 43s., Sheepbridge to 47s. 9d., and Powell Duffryn were 26s. Babcock & Wilcox at 65s. 9d., regained part of an earlier decline, as did Allied Ironfounders at 58s. 6d. Amalgamated Metal moved up to 20s. 6d. on hopes that the London metal market may be reopened shortly. British Aluminium have been active at 44s. 9d. on further news of the increasing uses of the metal and on the company's interest in the newly-formed Aluminium Wire and Cable Co. in which Hawker Siddeley Aircraft and Tube Investments are also interested.

Electrical equipments lost a small part of earlier gains, although this section was helped by the large volume of business likely to accrue in future from railway electrification schemes. General Electric were 101s. 6d. Associated Electrical 70s. Johnson & Phillips 79s., and English Electric 62s. 3d. Metal Box shares showed steadiness at £5¼ and Murex rallied to 90s., but in other directions, De La Rue have receded slightly to £13¼ and British Industrial Plastics were 7s. 3d. British Glues & Chemicals 4s. ordinary moved up further to 17s. Beecham deferred eased to 26s. 6d., Boots Drug were 60s. 6d., Sangers 34s., and Timothy Whites 46s. Oils have been uncertain, with Anglo-Iranian 95s. Shell 90s. and Burmah 65s. 7½d., although Trinidad Central rose 1s. to 23s. 6d.

Prices of British Chemical Products

REPORTS from almost all sections of the London industrial chemical market indicate a sustained demand with little, if any, improvement in the supply position. Contract deliveries are well up to schedule, but replacement business is somewhat influenced by the general firmness displayed throughout the market. There has been no abatement in the flow of export inquiries, though there is little prospect of fulfilling, in the immediate future, more than a part of the overseas requirements. The routine trade in the soda products section appears to be maintained, while a ready market awaits offers of the potash compounds. Formaldehyde, arsenic, sal-ammoniac, and hydrogen peroxide are in good call at unchanged rates, while acetic acid, oxalic acid and tartaric acid supplies are insufficient to meet the full current needs. There is little change to report in the coal-tar products market, where values continue very firm. Creosote oil and pitch are items for which there is an active demand.

MANCHESTER.—A steady outlet has been reported on the Manchester chemical market during the past week for textile bleaching, dyeing, and finishing materials, and both delivery specifications and new business in these have been on a satisfactory scale. Other leading industrial consumers on the home market are also calling for good supplies. Shippers have been anxious inquirers for a fairly wide range of chemicals, both light and heavy, and additional new business for export has been placed. At the moment, buying in the fertiliser market is largely concerned with slag and lime, with a moderate new business passing in superphosphates and the compound manures. Most of the tar products are moving steadily into consumption against existing orders.

GLASGOW.—The limited supplies forthcoming of general chemicals have made it difficult to meet even the moderate home demand during the week. Prices have been maintained firm, though there have been small increases in certain cases.

Price Change

Rise: Copper sulphate.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton, £47 10s.; 80% pure, 1 ton, £49 10s.; commercial glacial, 1 ton, £59; delivered buyers' premises in returnable barrels: £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r. MANCHESTER: £16 to £16 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER: £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb

Ammonium Bicarbonate.—MANCHESTER: £40 per ton d/d.

Ammonium Carbonate.—£42 per ton d/d in 5 cwt. casks. MANCHESTER: Powder, £43 d/d.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £19 10s. per ton. See also Salammoniac.

Ammonium Persulphate.—MANCHESTER: £5 per cwt. d/d.

Antimony Oxide.—£120 to £123 per ton.

Arsenic.—Per ton, 99/100%, £38 6s. 3d. to £41 6s. 3d., according to quality, ex-store.

Barium Carbonate.—Precip., 4-ton lots, £19 per ton d/d; 2-ton lots, £19 5s. per ton. bag packing, ex works.

Barium Chloride.—98/100% prime white crystals, 4-ton lots, £19 10s. per ton, bag packing, ex works.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £18 15s. per ton d/d; 2-ton lots, £19 10s. per ton.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax.—Per ton for ton lots, in free 1-cwt. bags, carriage paid: Commercial, granulated, £30; crystals, £31; powdered, £31 10s.; extra fine powder, £32 10s. B.P., crystals, £39; powdered, £39 10s.; extra fine, £40 10s. Borax glass, per ton in free 1-cwt. waterproof paper-lined bags, for home trade only, carriage paid: lump, £77; powdered, £78.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granulated, £52; crystals, £53; powdered, £54; extra fine powder, £56. B.P., crystals, £61; powder, £62; extra fine, £64.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£22 per ton, ex wharf. Granulated, £27 per ton.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5⅝d. per lb.

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Carbonate.—MANCHESTER: £8 15s. per cwt. d/d.

Copper Oxide.—Black, powdered, about 1s. 4½d. per lb.

Copper Sulphate.—£34 5s. per ton, f.o.b., less 2%, in 2 cwt. bags.

Cream of Tartar.—100 per cent., per cwt., from £12 14s. 6d. for 10-cwt. lots to £14 1s. per cwt. lots, d/d. Less than 1 cwt., 2s. 5½d. to 2s. 7½d. per lb. d/d.

Formaldehyde.—£27 to £28 10s. per ton in casks, according to quantity, d/d. MANCHESTER: £28.

Formic Acid.—85%, £54 per ton for ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1260 s.g., in tins, £4 16s. 6d. to £5 10s. 6d. per cwt., according to quantity; in drums, £4 2s. 6d. to £4 16s. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—11d. per lb. d/d, carboys extra and returnable.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d. per lb., according to quantity.

Lactic Acid.—Pale tech., £60 per ton; dark tech., £53 per ton ex works; barrels returnable.

Lead Acetate.—White, 70s. to 75s. per cwt., according to quantity.

Lead Nitrate.—About £70 per ton d/d in casks. MANCHESTER: £70 to £72.

Lead, Red.—Basic prices per ton: Genuine dry red lead, £71; orange lead, £83. Ground in oil: Red, £92; orange, £104. Ready-mixed lead paint: Red, £99; orange, £111.

Lead, White.—Dry English, in 8-cwt. casks, £83 per ton. Ground in oil, English, in 5-cwt. casks, £102 per ton.

Litharge.—£68 10s. to £71 per ton, according to quantity.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £36 per ton.

Magnesium Chloride.—Solid (ex wharf), £27 10s. per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., for 2-cwt lots. 9s. 1d.; smaller quantities dearer.

Mercurous Chloride.—10s. 1d. to 10s. 7d. per lb., according to quantity.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 3s. per gal.; pyridinised 64° O.P. 100 gal., 3s. 1d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£100 to £105 per ton in ton lots packed in free 5-cwt. casks. MANCHESTER: £5 to £5 2s. 6d. per cwt.

Paraffin Wax.—Nominal.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £76 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate. — Crystals and granular, 7½d. per lb.; ground, 8½d. per lb., for not less than 6 cwt.; 1-cwt. lots, ½d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £57 per ton for 5-ton lots, £57 10s. per ton for 1 to 5-ton lots, all ex store; hydrated, £51 per ton for 5-ton lots, £51 10s. for 1 to 5-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 8¾d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8d. per lb.; technical, £7 14s. 3d. to £8 6s. 3d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Salicylic Acid.—MANCHESTER: 1s. 9d. to 2s. 1d. per lb. d/d.

Soda, Caustic. — Solid 76/77%; spot, £16 7s. 6d. per ton d/d.

Sodium Acetate.—£42 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 6½d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite. — Powder, 60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£45 to £47 per ton.

Sodium Hyposulphite.—Pea crystals 19s. per cwt. (ton lots); commercial, 1-ton lots, £17 per ton carriage paid. Packing free.

Sodium Iodide.—B.P., for not less than 28 lb., 10s. 2d. per lb.

Sodium Metaphosphate (Calgon).—11d. per lb. d/d.

Sodium Metasilicate.—£16 10s. per ton, d/d U.K. in ton lots.

Sodium Nitrite.—£23 per ton.

Sodium Percarbonate.—12½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £25 per ton d/d for ton lots. Tri-sodium, £27 10s. per ton d/d for ton lots (crystalline).

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salt).—£5 5s. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. MANCHESTER: £4 12s. 6d. to £4 15s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot, £20 2s. 6d. per ton, d/d, in drums; crystals, 30/32%, £13 7s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £20 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £14 5s. to £16 10s., according to fineness.

Sulphuric Acid.—168° Tw., £6 2s. 8d. to £7 2s. 8d. per ton; 140° Tw., arsenic-free, £4 11s. per ton; 140° Tw., arsenious, £4 8s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—Per cwt., for 10 cwt. or more, £15 8s.; 5 to 10 cwt., £15 9s. 6d.; 2 to 5 cwt., £15 11s.; 1 to 2 cwt., £15 13s. Less than 1 cwt., 3s. 1d. to 3s. 3d. per lb. d/d, according to quantity.

Tin Oxide.—1 cwt. lots d/d £25 10s.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d; white seal, £54 5s.; green seal, £53 5s.; red seal, £51 15s.

Zinc Sulphate.—Tech., £25 per ton, carriage paid.

Rubber Chemicals

Antimony Sulphide.—Golden, 1s. 8½d. to 2s. 7½d. per lb. Crimson, 2s. 7½d. to 3s. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 8s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£37 to £41 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£44 to £49 per ton, according to quantity.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 10 5/16d to 1s. 5¾d. per lb.; dark, 10½d. to 1s. per lb.

Lithopone.—30%, £28 2s. 6d. per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Phosphate.—Imported material, 11% nitrogen, 48% phosphoric acid, per ton in 6-ton lots, d/d farmer's nearest station, in November £20 2s., rising by 2s. 6d. per ton per month to March, 1947.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, in November £9 17s., rising by 1s. 6d., per ton per month to March, 1947.

Calcium Cyanamide.—Nominal; supplies very scanty.

Concentrated Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. No. 1 grade, where available, £14 18s. 6d.

"Nitro Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £17 5s. per ton; granulated, over 98%, £16 per ton.

Coal Tar Products

Benzol.—Per gal. ex works: 90's, 2s. 6d.; pure, 2s. 8½d.; nitration grade, 2s. 10½d.

Carbolic Acid.—Crystals, 11½d. per lb. Crude, 60's, 4s. 3d. Manchester: Crystals, 9½d. to 11½d. per lb., d/d; crude, 4s. 3d., naked, at works.

Creosote.—Home trade, 5¾d. to 8d. per gal., according to quality, f.o.r. maker's works. Manchester, 6½d. to 9¾d. per gal.

Cresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. Manchester: Pale, 99/100%, 4s. 4d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £7 2s. 6d. to £10 per ton, according to m.p.; hot-pressed, £11 10s. to £12 10s. per ton, in bulk ex works; purified crystals, £25 15s. to £28 15s. per ton. Controlled prices.

Pitch.—Medium, soft, home trade, 75s. per ton f.o.r. suppliers' works; export trade, 120s. per ton f.o.b. suppliers' port. Manchester: 77s. 6d. f.o.r.

Pyridine.—90/140°, 18s. per gal.; 90/160°, 14s. Manchester: 14s. 6d. to 18s. 6d. per gal.

Toluol.—Pure, 3s. 1d. per gal.; 90's, 2s. 4d. per gal. Manchester: Pure, 3s. 1d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 3½d. to 3s. 6d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £15 per ton; grey, £22.

Methyl Acetone.—40/50%, £56 to £60 per ton.

Wood Creosote.—Unrefined, from 3s. 6d. per gal., according to boiling range.

Wood Naphtha.—Miscible, 4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. to 6s. 6d. per gal.

Wood Tar.—£6 to £10 per ton.

Intermediates and Dyes (Prices Nominal)

***m*-Cresol 98/100%.**—Nominal.

***o*-Cresol 30/31° C.**—Nominal.

***p*-Cresol 34/35° C.**—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb; 66/68° C., 1s.

***p*-Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

***o*-Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

***p*-Toluidine.**—2s. 2d. per lb., in casks.

***m*-Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

London.—November 13.—For the period ending Nov. 30 (December 7 for refined oils), per ton, naked, ex mill, works or refinery, and subject to additional charges according to package: Linseed Oil, crude, £135. Rapeseed Oil, crude, £91. Cottonseed Oil, crude, £52 2s. 6d.; washed, £55 5s.; refined edible, £57; refined deodorised, £58. Coconut Oil, crude, £49; refined deodorised £56; refined hardened deodorised, £60. Palm Kernel Oil, crude, £48 10s.; refined deodorised, £56; refined hardened deodorised, £60. Palm Oil (per ton c.i.f.), in returnable casks, £42 5s.; in drums on loan, £41 15s.; in bulk £40 15s. Groundnut Oil, crude, £56 10s.; refined deodorised, £58; refined hardened deodorised, £62. Whale Oil, refined hardened, 42 deg., £89; refined hardened, 46/48 deg., £90. Acid Oils: Groundnut, £40; soya, £38; coconut and palm-kernel, £43 10s. Rosin: Wood, 32s. to 45s.; gum, 44s. to 54s. per cwt., ex store, according to grade. Turpentine, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Organosilicic resins.—Soc. des Usines Chimiques Rhône-Poulenc. 29700.

Waterproof coatings.—Soc. des Usines Chimiques Rhône-Poulenc. 29791.

Aerosols.—Soc. pour la Mise en Valeur des Brevets et Procédés d'Aérosolation du Docteur Dautrebande Euratmos. 29292-5.

Solders.—Standard Telephones & Cables, Ltd., and E. L. Bodycombe. 29541.

Gaseous discharge devices.—Standard Telephones & Cables, Ltd., and A. H. Reeves. 29542-7.

Flow meters.—Stoppani A.G. 29555-6.

Heat exchangers.—W. W. Triggs. (Air Preheater Corporation.) 29400.

Treating magnesium-bearing brines.—W. W. Triggs. (Dorr, Co.) 29684.

Vegetable drying oils.—W. A. Waldie, and H. A. Toulmin. 29536.

Hydro-extractors.—Watson, Laidlaw & Co., Ltd., and P. Russell. 29804.

Polymers.—Westinghouse Electric International Co. 29401.

Coatings.—American Viscose Corporation. 30149-50.

Hydrocarbon oils.—Anglo-Iranian Oil Co., Ltd., F. W. B. Porter, and J. W. Hyde. 30280.

Hydrocarbons.—D. Balachowsky. 30151

Maleamic acid.—Beck, Koller & Co. (England), Ltd., R. S. Robinson, and E. L. Humburger. 30066.

Biguanide derivatives.—S. Birtwell, A. F. Crowther, F. H. S. Curd, J. A. Hendry, D. N. Richardson, F. L. Rose, and I C.I., Ltd. 30110.

Sylvan.—J. G. M. Bremner, R. K. F. Keeys, D. J. Jones, and I.C.I., Ltd. 30357.

Furfuryl alcohol.—J. G. M. Bremner, R. K. F. Keeys, D. J. Jones, and I.C.I., Ltd. 30358.

Iron, etc., alloys.—N. E. Brookes. (Isthmian Metals, Inc.) 30537-8.

Nitronitriles.—J. L. Charlish, W. H. Davies, J. D. Rose, and I.C.I., Ltd. 30108.

Diamines.—J. L. Charlish, W. H. Davies, J. D. Rose, and I.C.I., Ltd. 30109.

Deposition of aluminium.—Chemal-Trust. 30590.

Ethers.—Ciba, Ltd. 30159-60.

Sulphuric acid.—F. A. F. Crawford, J. Bell, and I.C.I., Ltd. 30111.

Neutralisation of acid solutions.—De Directie van de Staatsmijnen. 30068.

Hydrocyanic acids.—E.I. Du Pont de Nemours & Co. 30112.

Organic compounds.—E.I. Du Pont de Nemours & Co., W. F. Gresham, and R. F. Brooks. 30261.

Silicon compositions.—H. G. Emblem, C. Shaw, and W. E. Smith. 30441.

Sulphuric acid.—A. M. Fairlie. 30052.

Vinyl halides.—B. F. Goodrich Co. 30254.

Monomeric materials.—B. F. Goodrich Co. 30255.

Coherent coatings.—B. F. Goodrich Co. 30256.

Latices.—B. F. Goodrich Co. 30384.

Thermoplastic films.—B. F. Goodrich Co. 30385.

Coating alloys.—H. E. Gresham, M. A. Wheller, and D. W. Hall. 30146.

Hydrocarbons.—Internationale A.G. für Gassynthesen. 30473.

Butadiene.—Koppers Co., Inc. 30022.

Ketones.—Koppers Co., Inc. 30024.

Sulphuric acid.—Krebs & Co., Ltd. 30216-7.

Soldering of aluminium, etc.—G. J. Kuipers. 30041.

Azo dyestuffs.—M. Mendoza, and I.C.I., Ltd. 30533.

Chemical compounds.—Merck & Co., Inc. 30461.

Synthetic resins.—Mississippi Valley Research Laboratories, Inc. 30305.

Palladium soldering.—Mond Nickel Co, Ltd. 30609.

Diallyl phthalate.—N.V. de Bataafsche Petroleum Maatschappij. 30585.

Insecticides.—Pal Chemicals, Ltd., and F. E. Smith. 30452.

Treatment of water.—Permutit Co., Ltd., R. T. Pemberton, and H. S. Lawrence. 30075-6.

Emulsifiers.—L. Powell. 30497.

Methacrylates.—Ridbo Laboratories, Inc. 30135.

Thixotropic gel systems.—Sharp & Dohme, Inc. 30059.

Treating granular material.—H. S. Simpson. 30133-4.

Organo-silicic oils.—Soc. des Usines Chimiques Rhône-Poulenc. 30329.

Aluminium soap.—Standard Oil Development Co., Ltd, and J. C. Arnold. 30579.

Piezoelectric crystals.—Standard Telephones & Cables, Ltd. 30399.

Decalcomas.—A. H. Stevens. (American Decalcomanid Co., Inc.) 30388.

Complete Specifications Open to Public Inspection

Magnesium and magnesium base alloy castings.—Aluminium Co., of America. March 7, 1945. 6973/46.

Compositions for the prevention and destruction of weeds.—American Chemical Paint Co. March 20, 1944. 26489/46.

Electrolytical oxydation process for aluminium and its alloys.—R. M. Berthier. Oct. 2, 1939. 26667/46.

Manufacture of organic compounds.—

British Celanese, Ltd. April 12, 1945. 11175/46.

Manufacture of piperidyl ketones.—Ciba, Ltd., April 10, 1945. 8785/46.

Process for the degradation of steroid compounds.—Ciba, Ltd. April 13, 1945. 10450/46.

Manufacture of semi-esters of unsaturated dicarboxylic acids.—Ciba, Ltd. April 9, 1945. 10897/46.

Polymerisation or interploymerisation of mono-olefins.—E.I. Du Pont de Nemours & Co. June 24, 1942. 10120/43.

Manufacture of polymers and interpolymers of ethylene.—E.I. Du Pont de Nemours & Co. June 26, 1942. 10422/43.

Process for the production of resinous products.—E.I. Du Pont de Nemours & Co. Aug. 6, 1942. 12691/43.

Polymerisation products of ethylene.—E.I. Du Pont de Nemours & Co. Jan. 1, 1943. 21924/43.

Acrylonitrile polymer yarn.—E.I. Du Pont de Nemours & Co. July 28, 1943. 14434/44.

Production of form-stable, rubber-like polyvinyl *n*-butyl ethers.—General Aniline & Film Corporation. April 11, 1945. 9522/46.

Process for the production of organic amides. General Aniline & Film Corporation. April 12, 1945. 11563/46.

Process for quickly drying fatty paints and other products containing siccative oils.—General Color Soc. Anon. April 13, 1945. 27140/45.

Bleaching of cellulose.—Hercules Powder Co. April 13, 1945. 31383/45.

Manufacture of carboxylic acids.—I.C.I., Ltd. April 10, 1942. 5859/43.

Manufacture of chlorinated olefines.—I.C.I., Ltd. April 10, 1942. 5860/43.

Polymerisation and inter-polymerisation of mono-olefins.—I.C.I., Ltd. June 25, 1942. 10285/43.

Manufactutre of light-polarising materials.—International Polaroid Corporation. April 11, 1945. 10010/46.

Carrying out of chemical reactions.—International Pulverising Corporation. May 2, 1942. 26759/46.

Catalytic treatment with hydrogen of glyceride oils or fats.—Lever Bros. & Unilever, Ltd. April 13, 1945. 11327/46.

Preparation of sulphanalamido heterocycles.—Merck & Co. April 10, 1945. 10209/46.

Dehydrogenation of hydrocarbons.—Shell Development Co. March 16, 1942. 5638/43.

Execution of catalytic conversions in the presence of ferrous metals.—Shell Development Co. March 28, 1942. 6532/43.

Isomerising hydrocarbons.—Shell Development Co. May 16, 1942. 8529/43.

Separation of mineral mixtures.—F. L. Smidth & Co. A/S. March 23, 1945 26758/46.

Separating a liquid from solid material.—Soc. Anon. Française pour la Separation L'Emulsion et le Melange. (Procédés S.E.M.) April 12, 1945. 10456/46.

Refining, mixing and calibrating pulverulent material and the like operations.—Soc. Anon. Française pour la Separation L'Emulsion et le Melange. (Procédés S.E.M.) April 12, 1945. 10457/46.

Process for preparing zirconium compounds.—Soc. de Produits Chimiques des Terres Rares. March 29, 1945. 9463/46.

Preparation of therapeutically useful heterocyclic compounds.—Soc. des Usines Chimiques Rhône-Poulenc. April 13, 1945. 6897/46.

Sulphonamides.—Soc. des Usines Chimiques Rhône-Poulenc. April 11, 1945. 8236/46.

Manufacture of pyrazine.—Soc. des Usines Chimiques Rhône-Poulenc. April 11, 1945. 9196/46.

Machine for the mechanical treatment of straw and the like lignous or cellulosic material with a view to its transformation into artificial manure.—J. Stieffatre. April 9, 1945. 4228/46.

Manufacture of sulphur trioxide.—H. F. A. Topsoe. April 12, 1945. 10938/46.

Process and apparatus for producing a coating of discrete metallic particles particularly the mosaic surface of the target of an electron camera tube.—Western Electric Co., Inc. April 29, 1943. 4773/44.

Complete Specifications Accepted

Process for improving the fastness of dyeings on cellulose esters matted with titanium dioxide.—Soc. of Chemical Industry in Basle. Feb. 13, 1942. (Cognate applications 3514/43 and 3515/43.) 581,176.

Process for the catalytic cracking of hydrocarbons.—Standard Oil Development Co. Feb. 12, 1942. 581,242.

Manufacture of lubricating compositions.—Standard Oil Development Co. Dec. 30, 1941. 581,243.

Process for the synthetic manufacture of hydrocarbon oils.—M. Steinschlaeger. Sept. 3, 1942. 581,174.

Drying of soap, and the manufacture of soap powder, flakes or the like.—E. T. Webb, and Baker Perkins, Ltd. Nov. 30, 1945. 581,203.

Derivatives for polymers and interpolymers of ethylene.—D. Whittaker, J. S. A. Forsyth, and I.C.I., Ltd. Dec. 4, 1942. 581,279.

Treatment of seaweed.—J. F. Williams. Aug. 14, 1944. 581,258.

Process for the continuous recovery of unpolymerised monomers from butadiene copolymers.—Wingfoot Corporation. Aug. 26, 1943. 581,185.

Apparatus for separating liquids.—W. Alexander. May 7, 1945. 581,359.

Electrolytic protection of metal surfaces against corrosion.—J. C. Arnold, (Stan-

dard Oil Development Co.) Dec. 8, 1943. 581,341.

Centrifugal apparatus for extraction of dust and tar from gases at high temperatures.—H. Balfour & Co, Ltd., W. L. Burns, and A. C. Bureau. Sept. 5, 1944. 581,316.

Impregnation and chemical treatment of fibrous materials and tissues for plastic and protective purposes.—H. P. Bayon. March 26, 1945. 581,391.

Plasticising of fabrics and the production of laminated fabrics therefrom.—British Celanese, Ltd. Sept. 3, 1943. 581,313.

Production of artificial filaments.—British Celanese, Ltd. March 4, 1944. 581,354.

Manufacture of nitrosulphones.—G. D. Buckley, and I.C.I., Ltd. Aug. 31, 1944. 581,303.

Pyrimidine compounds.—F. H. S. Curd, F. L. Rose, and I.C.I., Ltd. Sept, 29, 1943. 581,334.

Manufacture of pyrimidine compounds.—F. H. S. Curd, F. L. Rose, and I.C.I., Ltd. Feb. 4, 1944. 581,345.

Pyrimidine compounds.—F. H. S. Curd, F. L. Rose, and I.C.I., Ltd. Sept. 29, 1943. 581,346.

Production of polyvinyl alcohol films and sheets of reduced water-sensitivity.—E.I. Du Pont de Nemours & Co. April 23, 1943. 581,387.

Production of chlorinated derivatives of ethyl alcohol.—E.I. Du Pont de Nemours & Co. March 17, 1944. 581,431.

Azo dyestuffs.—E.I. Du Pont de Nemours & Co., and J. F. Froning. Sept. 1, 1944. 581,305.

Electrowinning of manganese.—Electro Manganese Corporatiton.—Aug. 19, 1942. 581,370.

Method for the recovery of reagents in the cuprammonium process used in the manufacture of fibres and filaments.—H. G. C. Fairweather. (Rayanier, Inc.) May 22, 1932. 581,366.

Curing of polymeric materials.—D. A. Harper, W. F. Smith, and I.C.I., Ltd. Feb. 24, 1944. 581,410, 581,439.

Process for improving cellulose-, or cellulosehydrate-, textile material.—Heberlein & Co., A.G. April 10, 1943. 581,418.

Process for rendering cellulosic fibres or fabrics, transparent.—Heberlein & Co., A.G. May 4, 1944. 581,436.

Polymerisation of methacrylic acid esters. —I.C.I., Ltd. Sept. 18, 1941. 581,280.

Polymerisation of vinyl esters of organic acids.—I.C.I., Ltd. Sept. 18, 1941. 581,281.

Manufacture of polymeric materials from butadiene or its homologues.—D. B. Kelly, and I.C.I., Ltd. Jan. 5, 1944. 581,343.

Preparation of organic flurine compounds. —Kinetic Chemicals, Inc. March 17, 1942. 581,405.

Production of citric acid by fermentation. —Merck & Co., Inc. May 8, 1943. 581,389.

Methylation of amines.—Richards Chemical Works. May 8, 1943. 581,427.

Method of separating soot, flue ashes, and flue dust from the combustion gases of firing plants, and means therefor.—L. von Roll für Kommunale-Anlagen A.G. May 12, 1943. 581,426.

Manufacture of salts of aminoalkyl esters. —Soc. of Chemical Industry in Basle. Dec. 4, 1941. 581,325.

Manufacture of condensation products.—Soc. of Chemical Industry in Basle. Nov. 27, 1942. 581,339.

Bonded silicon carbide refractory compositions. A. Abbey. (Carborundum Co.) Aug. 24, 1944. 581,528.

Refining of natural or synthetic fatty oils. —Aerovox Corporation. July 7, 1942. 581,483.

Synthetic gel catalysts and the conversion of hydrocarbon oils by means of said catalysts.—C. Arnold. (Standard Oil Development Co.) Sept. 25, 1944. 581,632.

Causticisation of green liquor produced in the alkaline processes of the manufacture of paper pulp.—Associated Pulp & Paper Mills, Ltd. April 27, 1943. 581,579.

Manufacture of chloral.—W. Bridge, and I.C.I., Ltd. Sept. 28, 1944. 581,635.

Process for the production of graphite.—British Iron & Steel Corporation, Ltd., H. L. Riley, and J. Taylor. July 1, 1942. 581,569.

Process for making mono-amino-ethyl sulphuric acid ester.—Carbide & Carbon Chemicals Corporation. Dec. 31, 1943. 581,539.

Polymerisation process.—Distillers Co., Ltd., J. J. P. Staudinger, M. D. Cooke, and D. A. Bennett. Sept. 6, 1943. 581,484.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV
No. 1430. — November 23, 1946 — Annual Subscription 21s. Overseas 26s.

Royal Commission on Equal Pay

IT does not seem so long ago—and many of those in later middle age can well remember it—when no "nice" girl would even dream of going out to business. When we ourselves first entered the chemical industry in the first decade of the century, the firm with which we were associated had just made an innovation that shook it to its foundations. The management had engaged three young ladies for the office staff! To be sure, in certain trades, such as hosiery and cotton, women were employed in large numbers, but these were in the lower wage groups, and the Victorian conventions were not shocked thereby. The employment of women in mines in an earlier and ruder age reminds us that at one time women worked alongside men at the hardest occupations. In still other conditions, in other countries or in other ages, women were regarded as those who did the really hard work, leaving their lords and masters to supervisory inactivity. The whirligig of time brings startling transformations. In 1938, out of some 12 million persons employed outside Government service, 25 per cent were women: by 1944 the war had brought this percentage up to 34. Women are found in every industry in one occupation or another and the fact must be faced that in this age, men and women work together without any great differentiation between the sexes. The demand for equal pay for the sexes for similar work has been insistent for some years and impelled the Government to set up a Royal Commission to give its opinion on a change which, "if it were introduced at all, would be intended to remain in force not merely for a 'Dunkirk period' of fevered demand and abnormal effort, but for as long ahead as can now be foreseen." That Commission has now reported.

There are both moral and material considerations that must affect the issue. It is an issue upon which those who write should exercise a good deal of caution. Those whose memories can travel back to the days of the suffragette movement will remember pontifical speeches by estimable (male) Members of Parliament in which the very idea of women possessing sufficient intelligence to deal with affairs outside the home was pooh-poohed in dignified and sonorous prose. The pronouncements of those eminent gentlemen were much applauded in those days. In this year of grace we regard them with amusement. Women have emerged from the centuries during which they were brought up not to concern themselves with anything more than

On Other Pages

the most trivial matters, when education for women was regarded as something not quite nice and certainly not to be encouraged, into a period when they mix freely and equally with the male world and take their share in whatever political, mental, and physical movements are afoot. It may well be that bodily and mentally their adjustment is not complete yet, but to the extent that it is not yet complete, we can be sure that it soon will be. In plain fact, subject to certain physical limitations, women are likely to be the equals of men in everything but the hardest physical work. Hard physical work will probably be eliminated with the coming into existence of more labour-saving machines, and we must look forward to a world in which the sexes will be able to do equal work, mental as well as physical, given equal educational opportunities. Whether the physiologists will agree with this analysis of the future we do not know; but in view of the advances made in the work done by women within the last 50 years, we give it for what it is worth as an indication that when considering the future "as long ahead as can be foreseen," considerable care must be exercised in forming judgments.

The material side of the argument may be summed up by the question: Do women in fact perform the same amount of work of an equally high standard and in an equal time as men? *So far as the material side of the argument goes, is not this the decisive factor?* There are some lines of work in which women cannot do the same amount as men; there are others in which they can do so, but require more supervision; there are still others in which they can do more than men. Each occupation must be treated on its merits, and the treatment may vary as time goes on. A demand *on material grounds* for equal pay to-day might be refused, but might be granted in a few years' time; there can be no absolute finality.

As an illustration, the employment of women chemists in works may be cited. There is no reason why women chemists should not be just as good as men; they may not generally be engaged in industry to the same extent as men, but there would seem to be no reason why they should not, and there have been outstanding women scientists. On the other hand, we heard of a laboratory in which the women were excellent within the laboratory, but would not go on to the works to take samples, temperatures, and so forth, on the grounds that the conditions were dirty and unsuitable for them. We do not doubt that this is a passing phase and that this difficulty will disappear in the near future; such occurrences should not cloud one's judgment of the issue.

On the moral side there is the difficulty that for various reasons women often stay in industry for a shorter time than men, and the cost of their training more often than not is wasted. Then again there is the very difficult question of family responsibilities. Some women *may* have equal responsibilities with men, but, in general, there are more people dependent on the earnings of a man in industry than those of a woman. How is this moral difficulty to be overcome? The report clearly shows that the depression of the standard of living of the family man caused by a family dependent upon him cannot be adequately compensated for by existing family allowances, income reliefs, and the benefits to be derived from the new social services. These benefits and reliefs, moreover, do not help the man who may have dependents upon him above school age. The comment has been made by one authority, with every justification, that it is upon this rock that the equal pay movement may well founder.

The report shows that in many industries and trades, the rates of pay for women is of the order of 65 to 80 per cent of that of men. In the professions, equal pay is the rule. Where the work done by women is equal to that of men, as in many professions, the principle that we have already enunciated holds, namely, that rates of pay should depend upon the quantity and quality of the work done There seems to be no reason why chemists of both sexes should not have equal pay. On the other hand, in many industrial occupations the Royal Commission sees reasons against equal pay. Here is one: It is said that men are more adaptable and versatile than women, and more resourceful in dealing with surprise situations, and therefore worth a higher retaining wage, even though when everything is running smoothly there may be little to choose between their performances. In other words, women would not be worth equal pay as chemical engineers, works managers, or foremen in charge of industrial plant. The Commission sums up their majority view as fol-

lows: "Our own impressions are that the inferior strength of women, coupled with their shorter industrial life, their greater tendency to absenteeism, and a certain relative lack of flexibility in response to rapidly changing or abnormal situations, are still important influences tending to depress the general demand for their labour compared with men's, and so to establish their wage at a lower level."

The Commission's report has disclosed the facts. It is for the nation to judge. We need only add that the Commission was not unanimous in its conclusions, the majority of the women members registering their dissent to the extent of claiming that the adverse features of women's work were over-estimated in the report.

NOTES AND COMMENTS

A New Directory

THE first edition of the *Directory of Independent Consultants in Chemistry and Related Subjects*, a copy of which reached us the other day, will fill a real need. Published by the Royal Institute of Chemistry, the directory contains particulars of independent consulting practices which are concerned with any of the various branches and applications of chemistry, or with certain closely related subjects, and in which Fellows or Associates of the R.I.C. are principals. Titles and addresses of the practices are given, together with an indication of the general scope of their activities and of particular fields of work in which they specialise. There is to be an annual revision of the directory and copies will be made available to all inquirers; further, the directory will be printed as an appendix to future issues of the Register of Fellows and Associates of the Institute. By these means it is hoped that particulars of all independent consulting practices in which members of the Institute are principals will be brought to the notice of industrial firms, Government departments and others who may have need of their services. This procedure will not only benefit individual consultants, who, under the ethical code of the Institute, have undertaken to refrain from advertising their individual practices, but will also serve the public interest by helping industry to obtain the best advice and assistance in the solution of its current problems and in fostering new developments. A wide range of subjects is covered by existing consulting practices, and it is evident that industrial firms, especially the smaller firms, and those whose operations are not primarily chemical, can have access to professional advice and assistance on many matters which hitherto may not have seemed to be connected with the development of their undertaking. The arrangement of the directory is based on the titles by which the consulting practices are commonly known, in alphabetical order. In addition, there is a name index, enabling reference to be made to the practice in which any particular member of the Institute is a principal; a geographical index; and a subject index, which serves primarily as an aid to the use of the information in the body of the directory.

Austere Oxford

A CORRESPONDENT of the *Daily Telegraph*, returning to Oxford University, where he was a pre-war undergraduate, has found to his dismay that the easy, go-as-you-please, work-when-you-will attitude has been replaced by a utilitarian earnestness. The ex-Servicemen, who comprise the majority of present-day university students, cause little trouble to the authorities. One head of a college at the end of last term had only to caution two men out of some 200. But with this greater self-discipline is a greater urge to serious study with a corresponding loss of interest in matters outside their own narrow field of work. This has become so marked that some of the younger and more stimulating tutors complain that their ex-Service pupils are working too hard, too earnestly, and with too utilitarian an aim. On their part the university authorities now treat the undergraduates as men, rather than boys. After all, as the correspondent remarks, if an ex-Service major asks for leave of absence to attend a board meeting, he cannot be treated as a truant schoolboy. But this attitude, coupled with the seriousness of the undergraduates in their search for knowledge, tends to make the university atmosphere more studious, grave, and profound. The

old-time sparkle with its informal but cosy breakfasts and teas is missing—partly, perhaps, due to the housing shortage and B.U.'s. University sport has also been hit by the " no time " pleas of the utilitarians. Colleges formerly renowned for their athletic prowess now have difficulty in raising a team at all.

Time for Play

THE correspondent, viewing this change in university life with some apprehension, argues that a little less earnestness on the part of the undergraduates and a greater appreciation of other things in life outside the confines of their work would not be amiss. This suggestion is one which could well be acted on by people outside the universities. We have noticed frequently that the place where lights are burning longest is in the research laboratory. Young research chemists, full of enthusiasm, put their whole heart and soul into their work. This is reasonable. But when they try to combine this with long hours of work as well, they will find that with no outside interest to balance their minds they lack new ideas, lose enthusiasm for their work, and generally become stale. Prolonged hard work is sometimes called for in chemical research. But let it be occasional only. If it becomes a daily occurrence the employer will lose in the long run.

The Photo-Essay

THE photo-essay is a new form of photo-journalism which is being applied to commercial and industrial use. A carefully planned and scripted sequence of still pictures is used to show the various stages in the manufacture of a product or the departmental structure of an organisation. Particularly in overseas marketing is an approach of this type of great value in explaining the large amount of work which goes into the making of British goods. Few people abroad have an accurate conception of the magnitude of manufacturing organisation in this country, and photography is an admirable means of showing the overseas buyer the producton resources of this country. An article dealing with the creation of a photo-essay on the production of penicillin by Mr. Jean Straker, one of the foremost exponents of this type of work, appeared recently in a photographic journal. This has been reprinted in leaflet form by Photo-Union, Ltd., the industrial and commercial photographers, who would be pleased to send a copy to any reader who writes to their offices at Studio House, 12 Soho Square, London, W.1.

Electron Jubilee Celebrations

THE fiftieth anniversary of the discovery of the electron by the British physicist, Sir Joseph Thomson, O.M., will occur next year. To mark this jubilee and to demonstrate the tremendous influence such an advance in pure physics may have on the life of the community, the Institute of Physics and the Physical Society are jointly arranging a series of meetings and other functions to take place on September 25 and 26, 1947, in London. A special exhibition which will remain open to the public for several weeks, will be held at the Science Museum, South Kensington, and will show the development of the vast range of modern industrial equipment from its earliest experimental origins.

Electrodepositors

RECENTLY restored to its rightful place after being " in store " during the war is the electrodeposition exhibit, which is now on view again in the Chemistry Section of the Science Museum, South Kensington, London. This is a condensed version of the Electrodeposition Exhibition which, it may be recalled, was organised by the Electrodepositors' Technical Society and held at the Science Museum in 1935, after which it was presented by the Society as a permanent exhibit. It covers most of the principal phases of electrodeposition, including decorative and protective plating, heavy deposition, electroforming, and electrotyping, anodising, rubber deposition, and electrodeposition research. The Electrodepositors' Technical Society, incidentally, celebrates its twenty-first anniversary this year, and the occasion is to be marked by a special gathering on December 7 at the Society's headquarters, Northampton Polytechnic, Clerkenwell, London. The first president, Mr. S. Field, is among many of the original members who have promised to be there; and representatives of sister societies are being invited. The Society continues to expand in membership and activities. An interesting programme has been arranged for the twenty-second session and over a score of new members have lately been enrolled.

The Inorganic Constituents of Coal*

Occurrence and Industrial Significance

by H. E. CROSSLEY, Ph.D., M.Sc., B.Sc. (Tech).

THE common conception of the inorganic constituents of coal is that they appear in their most familiar form as coal ash. Coal ash is not the inorganic mineral matter of coal, however; it is the residue from the ignition in air of those inorganic compounds which have not been volatilised. In most cases, 99 per cent or more of the ash consists of the free and combined oxides of the nine elements: iron, aluminium, titanium, calcium, magnesium, sodium, potassium, silicon, and sulphur. The amounts of individual oxides vary considerably, as shown in Table I, where unusually high and low amounts are italicised.

The coal minerals from which ash is derived have been described as occurring in two ways, " adventitious " and " inherent," the former class being separate from the coal, and the latter, part of the coal substance. The classification breaks down, however, as minerals may occur microscopically distinct from the coal, but intimately mixed with it. Accordingly, in this paper the minerals in coal will be discussed according to their mineralogical relationships, with a special discussion of so-called "trace elements."

The three main kinds of minerals associated with coals are shales or clays, sulphide minerals and the carbonate minerals. All three kinds are well known, the shales as hard and relatively heavy blackened lumps, the sulphides as silvery or golden patches or nodules in the coal, and the carbonates as thin white or rust-coloured plates in coal fractures. In South Wales, the carbonates more commonly occur as heavy black nodules, known as " brass-stone."

TABLE I.—*Specimen Coal Ash Analysis*

Sample number	Main constituents—per cent. SiO_2	Al_2O_3	Fe_2O_3	TiO_2	Mn_3O_4	CaO	MgO	Na_2O	K_2O	SO_3
1	40.35	34.36	16.05	1.05	0.08	1.78	0.99	1.60	1.59	1.18
2	48.30	31.85	9.29	2.77	trace	1.93	2.13	0.50	1.98	1.50
3	47.32	38.22	1.01	1.27	trace	6.29	0.78	0.39	0.89	3.63
4	28.82	25.72	31.62	0.76	trace	3.69	4.20	1.11	0.82	1.50
5	*16.87*	15.02	*63.01*	0.28	0.02	0.78	0.78	1.37	0.84	1.08
6	*63.74*	23.45	5.72	2.46	trace	1.43	0.72	—	—	1.12
7	25.70	33.31	10.57	0.68	*1.92*	13.80	1.65	3.60	2.96	5.87
8	*3.04*	*0.41*	43.92	0.33	0.67	*23.94*	4.22	0.47	0.11	*22.98*

The shaly matter associated with coals consists mainly of kaolin, micas, and felspars, with some quartz. In the United States, Ball[1] and Gauger[2] have identified the individual minerals in these classes. Some of these minerals are listed in Table II, from which it is clear that the shaly matter will contribute silica and alumina, with smaller quantities of the oxides of sodium, potassium, calcium, magnesium, and iron to the coal ash. Hicks and Nagelschmidt[3] have examined six samples of shales overlying anthracites in South Wales, and found the main constituent to be illite, a potassium aluminium silicate of the mica class accompanied by about 10 per cent of kaolin and 1 per cent of quartz.

Most of the shaly matter occurs in bands between, above or below the coal, and it is known to be the result of sedimentary deposition of mud or silt from rivers, lakes, or swamps. It has been shown by Sprunk and O'Donnell[4] that some shaly matter is intimately dispersed through the coal as streaks or spots, and that it also occurs as a filling in the skeletons of plant cells, particularly in the dull, powdery part of coal, called by Stopes " fusain."

TABLE II.—*Some Minerals Associated with the Shaly Matter in Coals*

Mineral	Approximate formula
Kaolin...	$Al_2O_3.2SiO_2.xH_2O$
Muscovite	$K_2O.3Al_2O_3.6SiO_2.2H_2O$
Biotite	$K_2O.MgO.Al_2O_3.3SiO_2.H_2O$
Epidote	$4CaO.3Al_2O_3.6SiO_2.H_2O$
Quartz	SiO_2
Prochlorite	$2FeO.2MgO.Al_2O_3.2SiO_2.2H_2O$
Penninite	$5MgO.Al_2O_3.3SiO_2.Sh_2O$
Albite	$Na_2O.Al_2O_3.6SiO_2$
Orthoclase	$K_2O.Al_2O_3.6SiO_2$
Hornblende	$CaO.3FeO.4SiO_2$
Augite	$CaO.MgO.2SiO_2$
Cyanite	$Al_2O_3.SiO_2$
Staurolite	$2FeO.5Al_2O_3.4SiO_2.H_2O$

The first significance of the shaly matter is the obvious fact that, as an incombustible substance, it is an adulteration of coal for most industrial purposes. The manner of occurrence of the shale may decide whether or not the coal can be economically cleaned, that is, freed from some of the mineral matter, for the market. Separate bands of shale might be easily removed by density separations, but it would not be practicable or economic to break the coal sufficiently to remove dispersed matter.

* A paper presented to the South Wales Section of the Institute of Fuel at the Royal Institution, Swansea, on November 8.

The nature of the individual minerals constituting the shale may be important in the studies of the causes of certain diseases of the lung, although as yet the connection has not been definitely established. A further industrial trouble which is connected partly with the shaly matter in coal is the formation of deposits on the external heating surfaces of boilers.

The only important chemical change which the shaly matter undergoes during the laboratory incineration of coal is the loss of combined moisture. In certain industrial processes, however, evidence has recently been obtained indicating further decomposition to silicon monoxide, or possibly to silicon. One of these is the manufacture of water gas, steam-raising being probably a second.

Pyrites Adulteration

The second of the main classes of minerals in coal consists mainly of iron pyrites, approximately FeS_2. It is possible that part of the FeS_2 may occur as marcasite. The difference is that pyrites occurs as cubic crystals and marcasite as orthorhombic crystals. Pyrites is usually golden, although the colour varies, and some specimens are greyish or silvery. Marcasite is rarely golden, but usually rather steely; and whereas pyrites can often be seen to be cubic with the naked eye, the crystal form of the material thought to be marcasite is too ill-defined to permit visual identification. It is thought that the pyrites in coal may have been formed *in situ* by the action of hydrogen sulphide on infiltrated iron solutions, the hydrogen sulphide having been formed by bacterial action.

Pyrites can be seen in joints and cracks in coal, also as bands, large nodules, veins, pyritised fossils, and pyritised fusain. As with clays, pyrites is sometimes distributed in a fine state of division throughout the coal substance, making cleaning impracticable by present methods. Often, however, the pyrites content of coal can be readily reduced in amount by the usual methods of coal cleaning, including hand-picking. This led to a special wartime significance, for pyrites recovered from coal was isolated sufficiently pure to contribute to the manufacture of sulphuric acid, and thus save imports. Apart from this, however, pyrites is an undesirable adulteration of coal, being the cause of from half to two-thirds of the total sulphur present in many coals, and hence in the atmosphere of towns. When coal is carbonised part of the sulphur is volatilised, and has to be removed by recombination with iron. Oxides of sulphur are present in boiler flue gases, and these lead to corrosion of some of the cooler parts of the system and to the formation of deposited salts.

When coal is exposed to air, the pyrites oxidises to give ferrous and ferric sulphates and free sulphuric acid, and when the pyrites occurs in the joints this change causes fracture of the coal. The result is an undesirable increase in the amount of fines present, commonly observed with stored coal.

Some coals oxidise slightly in the first few days after mining, and when these coals are washed the iron sulphates hydrolyse, contributing sulphuric acid to the washery water. Corrosion of the washery plant may ensue, particularly if the concentration of acid is raised by repeated recirculation of the water.

The third main class of minerals in coal is that of carbonates. Calcite, $CaCO_3$, is common in coals, but in English coals minerals of the ankerite class occur more frequently. The latter minerals are double, triple, or quadruple carbonates of calcium, magnesium, iron, and manganese, generally $2CaCO_3$, $MgCO_3$, $FeCO_3$, in rhombohedral crystals. In South Wales the chief carbonate is often ferrous carbonate, and the mineral, known locally as brass-stone, approximates in composition to siderite, $FeCO_3$.

Ankerite is clearly seen as thin white plates in the joints and cleats of coal, these plates becoming slightly rust-coloured when the coal is stored, due to the oxidation of the iron. Thin bands of ankerite are often associated with the shaly matter in coal, and carbonates, like the clays, can fill the cell skeletons of the powdery coal, fusain. It is probable that the main source of ankerite in coal was solutions of the respective bicarbonates, entering by infiltration and suffering decomposition, with the deposition of the normal carbonates.

Effect of Burning

When coal is burned in air the minerals are changed, and the amount of change depends on the condition of ashing. The shales lose part of the combined moisture, the amount lost increasing with the temperature. The pyrites undergoes oxidation with the volatilisation of sulphur dioxide. If each particle of pyrites has full access to air, the product of the oxidation is ferric oxide at all temperatures from 700° C. to about 1000° C. Above 1000° C. the ferric oxide tends to change to ferroso-ferric oxide, or magnetite, Fe_3O_4. If, however, the coal is burned in thick layers, so that the supply of air is not adequate, ferrous sulphide, FeS, is formed. This accounts for the smell of hydrogen sulphide which may often be detected arising from damp domestic-grate ash, and possibly in part for the inadvisability of using domestic ashes in admixture with garden soil.

During the incineration of coal in air the carbonate minerals may react with sulphur dioxide produced by the sulphur in the pyrites and in the coal. Taking calcium

carbonate as an example, it is considered that the first product of the reaction is calcium sulphite which subsequently oxidises to calcium sulphate. These changes probably occur in the fuel beds of boilers, where the relatively high temperature can be expected to bring about a further reaction. The calcium sulphate, if formed, will be decomposed with the evolution of sulphur trioxide.

In the determination of the amount of ash given by coal, it is essential that the experimental conditions should be standardised to allow the results to be duplicated in other laboratories. For example, conditions should be arranged so that all the iron is in the ferric form, and the carbonates should be completely decomposed. These and other necessary conditions are ensured by the procedures described in the publications of the Fuel Research Station and the British Standards Institution.

The chief cause of the disagreement between analytical results is the variable fixation of sulphur dioxide by the bases present. For example, suppose coal A, rich in base and deficient in sulphur, is incinerated alone, the amount of ash obtained may be lower than if dishes containing coal A were placed behind dishes containing coal B, rich in sulphur, and incinerated otherwise under the same conditions. The bases in coal A will tend to pick up the sulphur gases emitted from coal B, making the ash heavier by the extra sulphur trioxide. To keep to a minimum the amount of sulphur fixed in the ash, and to ensure that results can be repeated, the determination of ash is best carried out in two stages, and in special muffle furnaces.[5] The first stage requires heating to 500°C. for 30 minutes, during which time most coals are ashed, but more important, the sulphur gases are set free while the bases are still relatively inactive. The residue is then heated for one hour at 750° to 800°C. in the second furnace, to complete the breakdown of carbonates.

Other Elements

The minerals which have been discussed contribute more than 90 per cent of the ash from coal, but the remaining inorganic compounds in coal have an interest and significance which merit special consideration. In addition to the constituents of the main minerals, over 30 other elements are regularly found in British coals. It is convenient to deal first with elements which occur in small quantities associated with the main groups of minerals.

The associations with carbonates and pyrites, which are to be discussed, might be deduced, as an association of similar compounds. With shales, however, such considerations are sometimes of little use, as the shales are fundamentally collections of detrital matter from the weathering of rocks, together with the remains of animal and vegetable bodies. Thus, in Quebec, a curious case was reported from a mica mine. There the usual situation was reversed, coal occurring as a chance associate of the mica, and in small quantities only. The ash of this coal contained 35 per cent[6] of uranium oxide.

Presence of Phosphorus

Most coals contain from 0.001 to 0.01 per cent of phosphorus, and this is often associated with the shaly matter. Phosphorus is an essential element to the life of most plants, but the range of amounts of phosphorus in dried plants is about ten times that in coals. It is possible, therefore, that during the process of forming coal, the organic matter may have contributed phosphorus to the nearby shaly strata. This was supported by analysis of the roofs and floors of coal workings, as the shaly strata contained five to ten times as much phosphorus as the coal between. In such cases it follows that the accidental inclusion of roof shale with the mined coal, so that the ash is increased from say 5 per cent to 10 per cent might raise the phosphorus content of the coal from a negligible amount to an appreciable quantity.

A mineral named as "apatite" was recognised by Ball[1] as in association with coal, and investigations by the present author were in agreement with this. Unfortunately, the name "apatite" has been frequently misused, as if it were the specific name of a mineral, and, indeed, it is sometimes thought that it is simple calcium ortho-phosphate $Ca_3(PO_4)_2$. Apatite is, in fact, the name of a family of minerals having the general formula $Ca_{10}R_2(PO_4)_6$. Most commonly R is fluorine, and the mineral concerned is called "Fluorapatite."

The phosphorus in coals is present as fluorapatite, which raises the point that fluorine occurs in coals, and must be considered along with the phosphorus, R. Lessing[7] and the present author[8] independently found fluorine in coal, in 1934. The latter work began with the investigation of the corrosion of glass bottles in an annealing kiln, found to be due to fluorine in the coal. Subsequent papers[9] dealt with the determination, mode of occurrence, and industrial significance of fluorine in coal. It was found that British coals contain from 20 to 150 parts per million of fluorine, and that the amount of fluorine could be estimated approximately, knowing the phosphorus content of the coal.

The hydrogen fluoride released from coal during combustion in a boiler may carry off silica as gaseous silicon tetrafluoride, and this gas could be expected to decompose later, possibly with the deposition of silica on the heating surfaces. It has also been found that the phosphorus can be volatilised from a boiler fuel bed, appearing in the gas eventually either as phosphoric acid

or anhydride. When considerable amounts of phosphorus are available, the formation of troublesome deposits is seriously aggravated.

Phosphorus is undesirable in metallurgical coke, for reasons similar to those which apply to arsenic, as mentioned later.

Loss of Fluorine

When coal is carbonised the fluorapatite releases a little hydrogen fluoride at low temperatures; at higher temperatures, about 1000° C., more than half the fluorine is released, and with steaming, the loss of fluorine from the coke is complete. An excess of ammonia is present, and ammonium fluoride is formed, and dissolved by the water in the gas scrubbers. The ammonium fluoride is then hydrolysed, giving free hydrofluoric acid, which has been known to cause serious corrosion of porcelain fillings. The reaction between dilute hydrofluoric acid and silica is to form hydrofluosilicic acid and silicic acid, as follows: $3SiO_2 + 6HF = H_2SiF_6 + 2H_2SiO_3$. Unfortunately, in the presence of more silica, the hydrofluosilicic acid behaves as if it were a mixture of 2HF and SiF_4, and while the HF is attaching the silica, as just described, the residual silicon tetrafluoride is hydrolised to give more hydrofluosilicic acid, and more silicic acid, thus: $3SiF_4 + 3H_2O = 2H_2SiF_6 + H_2SiO_3$. Thus the fluorine is passing through a cycle of reactions, and it is clear that a little fluorine could do a lot of damage in a gas-scrubber. In fact, one millionth of a gram of ammonium fluoride might disintegrate a ton of porcelain fillings were it not for the fact that fluoride ions are adsorbed by the silica gel corrosion product. Severe corrosion has been caused in this way in gas-scrubbers, however, as recorded by Lessing. Not all the fluorine passes on to the scrubbers; some is present in the condensed mixture of tar and liquor, and at Plean, Scotland, this led to the corrosion of the tar tanks[10].

Ten years ago little interest was shown in fluoride poisoning, and only acute poisoning, by relatively large amounts of fluoride, was well known. Since then, however, the medical profession has become increasingly interested in what is now called the disease "fluorosis," resulting from chronic fluoride poisoning. The symptoms, in various stages of severity, range from teeth mottling to acute curvature of the spine and locking of the joints. In its mildest form, the disease has been correlated with the daily intake of drinking water containing more than 1 part of fluorine per nillion. The newly discovered significance of traces of fluorine gave additional importance to the fluorine in coal, particularly when the coal is used for the drying of foodstuffs. Considering the particular example of the drying of malt in direct-contact kilns (see also arsenic), an examination of many samples of maltsters' coals, and the corresponding malts, culms, and beers showed that the fluorine vaporised from the coal, and was passed to the beer almost quantitatively. Fortunately, the amount of fluorine in the beers derived in this way was only about 0.6 part per million, although a few samples contained from 0.8 to 1 part per million. It must not be overlooked, however, that those were wartime beers, and that the stronger beers of peace time may require the selection of coals low in fluorine for the drying of malt.

A number of elements are to be found as sulphides, in small quantities, associated with the pyrites. It seems probable that their presence is due to the same causes as the pyrites. The most important of these elements is arsenic, occurring as the mineral mispickel, FeS_2FeAs_2, in amounts ranging from less than 1 to about 75 parts per million parts of coal, expressed as arsenic trioxide.

When coal is burned or carbonised, from a quarter to three-quarters of the arsenic is volatilised. The carbonate minerals help to retain arsenic, and prevent volatilisation, by forming arsenites and arsenates. Another inorganic constituent of coal increases the amount of arsenic volatilised, but this will be discussed later. The retention of arsenic in coke is undesirable if the coke is to be used for metallurgical purposes, as arsenic confers weakness on ferrous metals. The volatilisation of appreciable amounts of arsenic from burning coal is to be avoided when the combustion gases come into direct contact with foodstuffs during the process of drying. For example, this applies to the drying of malt in direct-contact kilns. For this purpose only coals known to be low in arsenic content are used by maltsters.

Copper and Zinc

Two other elements occurring as sulphides with the pyrites are copper and zinc. The amount is usually very small, but a certain Midland coal gave an ash containing over 2 per cent of CuO. This coal burned with a bright blue flame. A coal from the Cannock Chase area behaved unusually in a domestic grate, by giving dense masses of sublimate on the upper firebricks; the sublimate was yellowish when hot and white when cold, and proved to be zinc oxide. The coal contained over 1 per cent of zinc sulphide.

Lead sulphide, galena, is sometimes found in coals, and excessive amounts may have a toxic significance. Dunn and Bloxham[11] attributed the poisoning of some cattle to contamination of the pasture by lead and copper, which they claimed had been emitted from the boiler chimneys of a nearby factory.

It will be appreciated from the examples given that the copper, zinc and lead occur-

ring in coal are only partly retained in the ash, showing a further difference between coal ash and the original mineral matter.

In addition to the elements already mentioned, barium is usually found in small quantities, as barium carbonate, witherite. Coal ash commonly contains from 0.05 to 0.5 per cent of barium oxide, but occasionally barium has been found in coals in much greater quantities, particularly in Durham. In 1902 Briggs[12] found a vein of mixed witherite and barytes (carbonate and sulphate of barium) in the coal at Brancepeth Colliery, Durham, the thickness varying from a few inches to 16 ft. More recently, at a nearby colliery, it was observed that the coal contained much barium, the amount increasing as the working progressed. Eventually the workings reached a fault fissure, and on the other side of the fault, there was a thick vein of witherite. In the few years preceding the recent war, half the world's demand for witherite was supplied from this colliery. It is interesting to note, as a clue to the association with the coal across the fault, that the mine water was found to contain 10 grains of barium bicarbonate per gallon. At another colliery in this district, the amount of barium chloride in the mine water was sufficient to make possible the manufacture of "blanc fixe" for sale.

This ends the discussion of the main groups of minerals associated with coals, and the most important minor occurrences in those groups, but a large class of varied minerals remains to be dealt with, and they have distinct and important significances. These are the inorganic substances intimately dispersed through the coal.

Chlorine

Chlorine occurs in coals mainly as sodium and potassium chlorides, but smaller quantities of other alkali chlorides, and oxychlorides of calcium and magnesium, may be present. In addition, work done at the Fuel Research Station has shown that part of the chlorine is present as adsorbed ions, and a little is probably combined with the organic matter. Although most of the chlorine in coal is usually present as alkali chloride, only a part of this can be extracted with water unless the coal is ground to micron size (0.001 mm.), showing that part of the chlorine is intimately mixed with the coal substance.

British coals contain from 0.01 to 1 per cent of chlorine, and the larger amounts are undesirable for several industrial uses, particularly steam-raising. The presence of a relatively large amount of chlorine usually means that the coal contains a relatively large amount of sodium or potassium, and has an increased tendency to form clinker. The alkali may also attack the refractory bricks of the combustion chamber or help to form deposits on the external heating surfaces of the boiler. The chlorine is evolved as hydrogen chloride, which seems to have relatively little corrosive action in the flue system, possibly due to the presence of other stronger acids.

When coal is carbonised, part of the chlorine is evolved as hydrogen chloride, and this is immediately neutralised by the ammonia which is always present in excess. The ammonium chloride sometimes causes partial blockage of the cooler pipes, and after hydrolysis it may cause corrosion of metal tanks. The factors governing the release of chlorine during carbonisation are those which control the loss of fluorine, that is, temperature and moisture.

Corrosion Difficulties

In steam-raising, therefore, the corrosive action of hydrogen chloride is apparently prevented by the presence of other acids; in carbonisation it is limited by neutralisation. In small mobile producer units, however, severe corrosion by hydrochloric acid is possible. In one case a medium-temperature (800° C.) coke, relatively rich in chlorine, caused appreciable corrosion of the coolers, and of the filtering material, by hydrochloric acid. When coke was prepared from the same coal at 600° C. this low-temperature coke did not cause corrosion, although practically the same amount of chlorine was present. The answer to this problem was provided by the work of Cobb and Monkhouse[13] who found that raising the temperature of carbonisation of coal from 600° C. to 800° C. had a pronounced effect on the nitrogen compounds. An appreciable amount of nitrogen is evolved between the two temperatures, and, more important, the residual nitrogen at 600° C. is much more readily evolved as ammonia by stronger heating or steaming than is the case with 800° C. coke. Laboratory trials showed that the low-temperature coke concerned in the producer investigation would evolve sufficient ammonia to neutralise the hydrochloric acid generated, but the medium-temperature coke would not, and corrosion ensued for that reason.

The chlorine in coal has another effect, which hitherto has received little attention. The hydrogen chloride formed during the combustion of coal can react with various oxides present in the ash, to form volatile chlorides. It has been stated earlier that the amount of arsenic which is volatilised during the burning of coal depends on the fixative action of the bases present. Chlorine has a volatilising effect, as shown in the following example. A coal containing the equivalent of 60 parts of As_2O_3 per million contained only 0.02 per cent of chlorine, but was unusually rich in carbonate

minerals. When this coal was ashed, practically the whole of the arsenic was retained in the ash. Sodium chloride was added to a sample of the coal so that the chlorine content was increased to 1 per cent, and the mixture was ashed, as before. The ash now contained 25 parts of As_2O_3 per million (calculated on the weight of coal), so that the chloride had caused the volatilisation of over half the arsenic.

Rarer Elements

Over 30 elements are known to be present in different coals wholly in an intimate state of dispersion throughout the organic matter. Proof of this dispersion is shown by the fact that the percentage of these constituents increases proportionately with the removal of adventitious mineral matter, even when the coal is cleaned as far as is possible. Some of these substances may have infiltrated into the beds of decaying organic matter, before the coalification process developed, but it is also possible that they have been derived from the coal measure plants.

Boron is well known as an essential element for the life of several plant families, and it is one of the commonest minor constituents of coals. Traces of tin are found in the ashes of most plants, and it is equally common, to the extent of about 0.01 to 0.05 per cent, in the ash from clean coal. Similarly, traces of copper and zinc are common in plants and clean coal.

The occurrence of vanadium has a special interest. Ordinarily, clean coal contains at the most, faint traces only of vanadium, but in certain cases the brightest kind of coal, "vitrain," gives an ash rich in the element. This is generally true when the vitrain occurs as very thin bands in shales adjacent to the coal, or as the fossilised remains of a tree stump. Such specimens may give about one or two per cent of ash which can contain over ten per cent of V_2O_5. It is remarkable that the ashes of some samples of Whitby jet (jet is similar in appearance to vitrain) were also rich in vanadium, and it may be that the vegetation which gave rise to these substances stored vanadium, possibly as an essential element for healthy growth. Comparatively little is known of the value of vanadium to plant life, beyond the fact that vanadium cannot replace phosphorus in the biochemistry of plants. It has been found, however, that some parts of plants may be relatively rich in vanadium, an example being pine needles[14].

The inorganic matter intimately dispersed through the coal substance includes rare elements. These elements are usually present as spectrographic traces, but even so they occur in much smaller amounts, if at all, in the adjacent strata. Traces of germanium, gallium, thallium, rare earths, gold, platinum, iridium, rhodium are often detected in the ash, of clean coal. V. M. Goldschmidt[15] has suggested the following explanation. Plants such as deciduous trees have a large intake of water in the summer, and this water contains salts in solution. Normally there is too little moisture in the ground to dissolve all the commoner minerals within reach of tree roots, but occasional micro-traces of rare elements may be wholly dissolved, and taken into the tree. Thus the minerals present in the sap show a very different relationship from those in the ground, in that a much higher proportion of trace elements is present. Goldschmidt has found that the minerals in sap usually contain about 1,000 times as much of the rare elements as the ground. The sap finds its way into the leaves, and there moisture is evaporated, and the amount of inorganic matter steadily increases. Eventually the leaves fall, and rot, and the leaf-mould would give an ash which, like the salts in sap, is much richer in rare elements than the soil beneath. Occasionally, unsuspected veins of nickel, tungsten, etc., give rise to micro-traces of the element in the soil, and Goldschmidt has suggested turning this to commercial advantage. By carrying out spectrographic analyses of leaf-mould from various parts of a forest, and following directions indicated by a tendency towards increased concentration, he was able to indicate the presence of nickel in workable quantities in the ground. The method is erratic, and was said to be successful only about once in five or ten times.

Search for Germanium

The rare elements in coal may at any time have a practical value as well as an academic interest. A few years ago it had been found that tin was a good catalyst for the hydrogenation of coal. It was expected that germanium, as a sister-element of tin, would have some catalytic value. A search for germanium in British coals was organised, therefore, by the Fuel Research Board. It was found that the most promising area was that of Northumberland and Durham and the most promising seam was the Yard seam. Further, the richest parts of the Yard seam were those round Hartley colliery. In the two districts where most germanium was found, it was confined to relatively small parts of the workings, and the coal had to be cleaned so that it gave only about two per cent of ash, to remove the non-germaniferous mineral matter. Ashes were then obtained containing 0.3 to 0.5 per cent of GeO_2, a relatively high concentration of such a rare element. The ashes which were analysed had been prepared in a laboratory muffle furnace, and it became necessary to obtain larger quantities of ash. Coal was then burned in a domestic grate, but the ashes contained only

0.05 per cent of GeO_2. It was found that the reason for the loss was that coal burned in this way first undergoes limited oxidation with the air passing through the fuel bed. Carbon monoxide is present, and, of course, burns to carbon dioxide in the secondary supply of air above the fuel bed. Laboratory experiments confirmed that germanium was volatilised from coal by combustion in a reducing atmosphere, presumably after reduction to a germanous compound.

Following the example of the volatilising effect of chlorine on arsenic during the combustion of coal, experiments were carried out to find if this volatilising effect also applied to germanium. The experiments were positive, the introduction of 1 per cent of chlorine, as sodium chloride, to the germaniferous coal, caused the volatilisation of three-quarters of the germanium when the coal was ashed in the laboratory. This was not applied to the recovery of germanium from coal ash, as it was simpler to conserve the germanium by burning the coal in horizontal retorts.

It may be reasoned from what has already been stated, that there would be two ways of obtaining relatively volatile elements from coal. One would be by incinerating the coal in such a way that volatilisation is discouraged; this was done in the recovery of germanium. Alternatively, the coal could be burned under reducing conditions, with insufficient air passing through the fuel, to encourage gasification, the element sought being condensed from the gases. Volatilisation of the more volatile elements from coal is almost complete in some industrial boilers and in all producer plants, and condensation occurs in the flues and pipes as the temperature falls. Morgan and Davies[10] examined a large number of boiler-flue dusts, and producer dusts, for the presence of germanium and gallium. In the majority of cases, Durham coal had been used. These dusts mostly contained from 0.2 to 0.9 per cent of germanium, and 0.1 to 0.5 per cent of gallium. These investigators calculated that the boiler and producer dusts of the whole country could be made to yield 2,000 tons of germanium and 1,000 tons of gallium annually. The dusts contained smaller quantities of silver, indium, thallium, cerium, lanthanum, and vanadium. There is a commercial development for the recovery of vanadium from the flue dusts of boilers burning certain fuel oils.

Combustion Gases

Brief mention has already been made of mobile producer-gas units, and the generation of hydrogen chloride and ammonia. The chief gases present are carbon monoxide, from the combustion of solid fuel in a limited supply of air, and nitrogen, residual from the air. The maximum temperature of the combustion zone is probably above 1500° C., and at this temperature a considerable amount of ammonia is formed, possibly by the direct union of nitrogen and hydrogen. The hydrogen comes from the fuel and from the action of moisture in the fuel, or in the air, on the carbon. Sulphur vapour is also present, formed by the thermal decomposition of the pyrites in the fuel, or by the interaction of sulphur dioxide and hydrogen sulphide. The sulphur dioxide comes from the preliminary ignition of the sulphur in the fuel. Sulphur trioxide is also present, as a result of the thermal decomposition of sulphates, and the hydrogen sulphide is probably formed by the action of hydrogen on the ferrous sulphide residue of the pyrites or on the organic sulphur in the coal. Hydrogen cyanide is synthesised by the direct combination of the elements, or the action of ammonia on carbon. Further reactions take place in the vapour phase, and when the gas is cooled salts are condensed. Producer gas can carry in suspension several hundred milligrams of dust per cubic metre of gas, three-quarters of the dust being solid matter blown out of the fuel bed. This is mainly the fuel itself, partly burned, with particles of mineral matter. The remainder of the dust consists of the volatilised inorganic constituents of the fuel, such as arsenic, boron, germanium, with elementary sulphur, and many ammonium salts formed by the gas reactions. Of these ammonium salts, chloride, fluoride, sulphate, thiosulphate, cyanide, and thiocyanate have been identified. Thus, producer dust is remarkable in that a considerable amount of the inorganic matter may be formed from the organic matter of coal.

Deposits on Boilers

With regard to deposits on the outside of the heating surfaces of boilers, these can also be very different in composition from the ash of the coal. The boiler surfaces act as a concentrating system for acids, alkalis, and various elements present only in traces in the coal. In a modern boiler plant, the flue dusts contain very little, if any, soot. Hard deposits can contain up to 45 per cent of phosphate (P_2O_5), however, and as much as 15 per cent of borate (B_2O_3) has been found. These deposits have become a serious problem to the electrical power industry, but further details of the problem are beyond the scope of the present paper.

This concludes a necessarily brief survey of the wide field of study concerned with the occurrence and significance of the inorganic constituents of coal. Much further study is warranted for the alleviation of industrial troubles and possibly to provide useful by-products from what is at present waste matter in coal.

This paper is based upon work forming part of the programme of the Fuel Research Board of the Department of Scientific and

Industrial Research, and is published by permission of the Director of Fuel Research.

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Anti-Corrosive Pigments

London O.C.C.A. Discussion

AT a meeting of the London Section of the Oil and Colour Chemists' Association at Manson House, 26 Portland Place, W.1, on November 13, there was a discussion on anti-corrosive pigments. Mr. R. J. Ledwith, chairman of the Section, presided.

The discussion was opened by Dr. F. Wormwell, who dealt with the electrochemical aspect of the subject. He pointed out that the natural tendency of metals was to return to the state in which they were found in nature. Stainless steel and aluminium formed oxide films that were insoluble and protected the metal, but most products of corrosion were soluble and, with moisture present, produced active electrochemical effects. Pigments were used as corrosive inhibitors, some acting as cathodic and others as anodic inhibitors. He discussed their action with the problem of the solubility of the active agent and of local leaching when the solubility was too high. With regard to ships' bottom paints, he referred to accelerated tests which indicated that under marine conditions red lead in a chlorinated rubber medium acting as an anodic inhibitor gave good results, whereas red lead in linseed oil failed and seemed to act as a cathodic stimulant.

Mr. R. M. Wilson, who dealt with the subject from the angle of a manufacturer of anti-corrosive pigments, queried what connection there was between the anti-corrosive properties of the various pigments and their composition. He complained that many tests and studies were made apparently on the assumption that such pigments as red lead and zinc chromate from all sources were identical in behaviour. The presence of litharge in red lead could have a pronounced effect; the solubility of zinc chromates made by different methods varied widely and differed in composition from the theoretical; similarly with zinc tetrahydroxy chromate. Particle size was another factor which he considered might have a direct bearing on the behaviour of a pigment, particularly when considering films impervious to water.

Mr. N. A. Bennett said that the electrochemical theory of corrosion propounded by Dr. Wormwell was not the complete answer to corrosion troubles; a more serious factor was the extremely uneven surface of steel, often containing pockets and points that were difficult to coat with paint. He considered that contact with the surface and adhesion were the keys to the problem. Iron oxide gave protection with no electrochemical action, and he suggested that the fineness of particle size allowed it to penetrate into the defects of the surface to a far greater extent than was possible with the coarser pigments, such as ferrous ammonium phosphate; that accounted for its high qualities. Zinc and bonderising treatments were discussed, and it was emphasised that for those treatments perfect cleaning of the metal was essential. Paints were seldom applied to surfaces in ideal conditions.

In the course of a general discussion which followed, Mr. Reynolds asked for information with regard to the utility of cyanamides as anti-corrosive pigments.

Mr. Bennett said he did not think they had been used in this country to any extent. The Germans had made considerable use of lead cyanamide during the war, and he would not be surprised to hear that the Americans had also. Obviously we were not very well placed to make cyanamide here, and he doubted whether anyone had used it commercially. An American paper had referred to its results as having been very successful.

Dextrine Now Available as Glue Substitute

At the request of the Board of Trade, the Ministry of Food has agreed to make reasonable quantities of dextrine available to manufacturers who normally use glue or gelatine. It is hoped that this will help to alleviate the present shortage of glue. The dextrine will come either from home production, for which the Ministry will allocate ingredients, or from imported supplies. Manufacturers who can substitute dextrine for glue or gelatine are invited to apply to the Ministry of Food, Starch Division, London Road, Stanmore, for a permit to acquire supplies.

Cement Works at Tura, Egypt*

High Standard of Product

THERE are two cement works in Egypt, one at Helwan, the other at Tura, but the latter, with an annual production of about 280,000 tons, produces twice as much as the Helwan company. The markets for the cement are Egypt itself, Palestine, Syria, and even France and Italy. The chief demand is for ordinary Portland cement, but rapid-hardening and other types are produced when required. In regard to quality, the requirements of the B.S.S. are adhered to, in fact, the actual standard of the product is well above the specification. For instance, for 1 : 3 cement mortar, B.S.S. requires a tensile strength at three days of 300 lb./sq. in., and at seven days of 375 lb./sq. in., but the figures for the tests at three days and seven days on an average are 400 lb./sq. in. and 470 lb./sq. in. respectively. Neat cement tensile tests average 990 lb./sq. in. at seven days.

Tura is about 22 miles from Cairo, and the works, one of the largest cement works in the world, are handy for both the railway and the Nile. The limestone hills extend for nearly a distance of 100 miles, and the quarries for this material, as well as clay, contain a practicably inexhaustible supply. Moreover, these two materials are easily accessible and are within handy working distance of each other. Clay is quarried at two different levels, that at the higher level containing a greater proportion of silica.

The distance from the quarries to the crusher house is 1½ miles. A hauling rope brings the material in buckets at the rate of 130 per hour to the crusher house. After passing through a hammer crusher, the mixture of limestone and clay is deposited into a hopper, and from there is fed into a ball mill where water is added. The ball mill is 60 ft. long, 9 ft. in diameter, and can hold 80 tons of material. It is driven by a 1250 h.p. motor, and revolves at 20 r.p.m. The mixture emerges from the ball mill in the form of a slurry and is then pumped into one or other of eight circular blending basins each of 500 tons capacity. The basins, 30 ft. in diameter, and about 40 ft. high, are built of steel plate and lined inside with an 8-in. core of concrete. From time to time, the slurry is stirred up by compressed air from a pipe in the middle of the tank. Periodic laboratory tests are made to check the lime content, and corrections made accordingly.

The slurry is next pumped to a large, circular, reinforced concrete holding basin, carrying a travelling bridge on a single rail on the tank wall. Suspended from the bridge are five revolving frames immersed in the slurry to agitate it. The slurry is then ready to enter the revolving kilns, but after leaving the holding tank it is first pumped to a tower where the quantity entering the kilns is controlled. Two of the kilns are 270 ft. in length, and the third 500 ft. This third kiln, the second longest in the world,

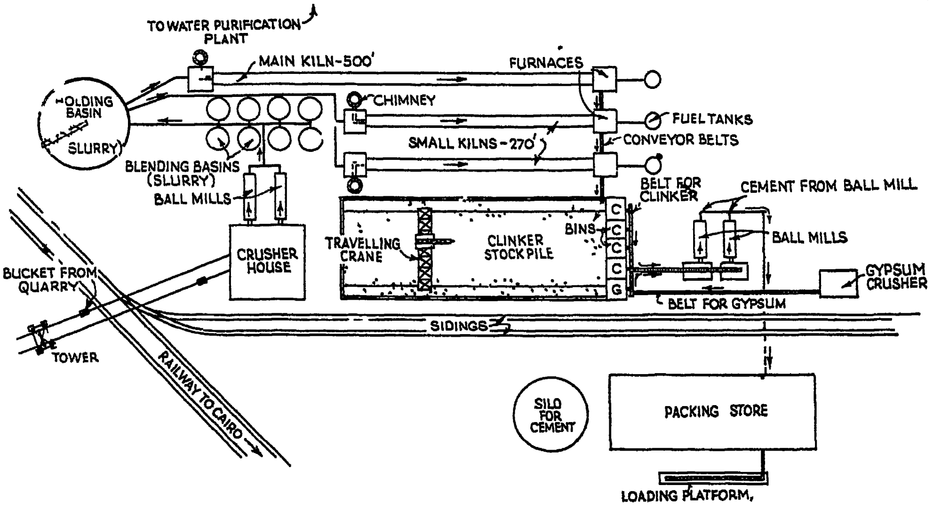

Diagram showing lay-out of Tura Cement Works (not to scale).

*Condensed from *New Zealand Engineering*

is 12 ft. in diameter, steel plated, lined with fire brick, and with a barrel temperature of 1450° C. It is supported by seven intermediate revolving bearings, which are capable of adjustment to correct the "down hill" tendency of the kiln due to its slight inclination from the horizontal. It revolves at 1 r.p.m. and is driven by an 80 h.p motor. The charge takes four hours to pass through the kiln, from the slurry stage at the one end to the clinker stage at the other. The output of this kiln is 400 tons per day. The daily output of clinker from the three kilns is 1000 tons.

Gypsum is added to the cement to retard the setting time. Clinker is conveyed on one belt, gypsum on another, and the two are deposited into a common bin, then elevated to a measuring bin at the head of a ball mill, of which there are two, each operated by a 600 h.p. motor. The clinker-gypsum mixture (960 lb. of clinker to 40 lb. of gypsum = 1000 lb. of cement) is fed to the ball mill, pulverised, and emerges as cement. The finished product is then conveyed to the packing store and bagged in either jute or paper bags of 50 kg. capacity. By means of a rotary filler having ten radial nozzles one man can bag 70 tons of cement per hour.

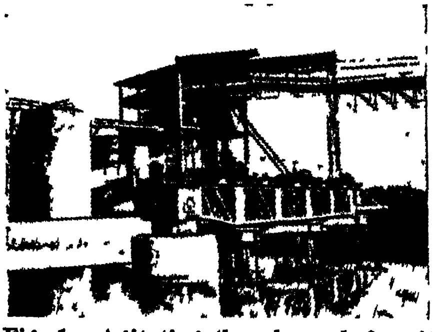

Fig. 1. Agitating the slurry before it passes to the kilns.

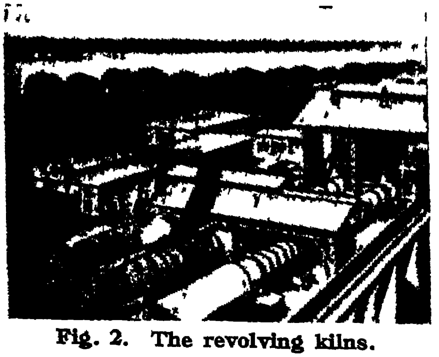

Fig. 2. The revolving kilns.

Prior to the war, coal for fuel was imported from Cardiff, and used for all firing purposes. Later it became necessary to use fuel oil produced near the Red Sea. This represents a rather expensive item, and it became necessary to adopt accurate measuring devices to check the supply and use of the fuel.

The pre-war cost of cement was £1 18s. per ton but, owing to the increases in wages, materials (and particularly the changeover from coal to oil), maintenance costs, transport, etc., the price has risen to £4 10s. per ton. The efficient layout of the whole works is a tribute to its Swiss designers.

Fig. 3. This revolving kiln is the second longest in the world.

A new leaflet (No. 466) has been issued by the Visco Engineering Co., Ltd., Stafford Road, Croydon, which, with general specification and details of capacities and dimensions, and photographs of the various models, sets forth the firm's range of "Viscozone" generators. Models illustrated are the S/2 deodoriser, embodying ozone concentration control knob and circuit-breaker toggle; the ceiling model PS/8, which can also be made for rigid mounting from roof support pillars and is supplied with remote control box; FS/8, mounted on a trolley and incorporating circulating fan and "Visco" air filter; and the HP/8 type, with high-pressure blower enabling ozone to be injected into rooms with high humidity. Also shown on its special trolley is the generator type HP/24 unit.

Explosions in Chemical Works

Methods of Minimising the Results

THE second of a series of three lectures by H.M. Inspectors of Factories on "Fire and Explosion" was given at a meeting of the London Section of the British Association of Chemists, on October 23, by Dr. D. Matheson, M.A., B.Sc., Ph.D., who dealt with: "Methods of Minimising the Results of Explosion." Dr. F. W. Stoyle was in the chair.

The lecturer began by outlining methods of preventing injury to the employee:

1. Preventing the explosion by eliminating dangerous concentrations of dusts or vapours.
2. The removal of all possible ignition points.
3. The prevention of small explosions becoming big ones.
4. The protection of the employee if an explosion occurs.

It was emphasised very strongly that the removal of all ignition points was almost impossible, but the removal of as many as possible was at least an added safeguard, the prevention of dangerous concentrations of dusts and vapours being the most important precaution.

Sources of ignition are numerous and the possible precautions vary widely. To obtain indication of temperature rise where there are large stocks of organic solids, thermometers or pyrometers should be inserted; then the overheating stack can be broken down. The pyrometers can be arranged to give visible or audible warning. Overheating stacks may reach a temperature sufficiently high to flame, and decomposition products may explode. Ferrous sulphide present in steel vessels used in the treatment of sulphur containing compounds may spontaneously inflame if allowed to dry in the presence of air. The vessels should be fitted with water sprays to keep the walls wet.

Precautions

Heaters are sources of ignition; safe gas heaters are available, with all the heating elements completely enclosed. The inlet for the air and the outlet for the waste gases are carried through the wall of the workroom. Other precautions are the prevention of smoking (smokers always carry matches or lighters); the use of beryllium-bronze tools which are non-sparking; the use of shoes having no steel nails (the wooden soles are pegged to the uppers with wooden pegs); the frequent examination of bearings, etc. The use of heat-changing paint is very useful for easy checking of the temperature of bearings.

Grinding machinery is a frequent source of explosions. Grinding itself produces heat, but the accidental ingress of pieces of tramp iron or pebbles causes considerable heat rise. Various magnetic separators are available for the removal of iron, but these do not remove pebbles. For the removal of the latter, pneumatic systems are used; the current of air blows the material upwards, while the heavy pebbles fall against the air current. This system is extensively used in coal grinding plant. Flameproof apparatus falls into four classes, depending on its suitability for use with various types of vapours or gases. For example, grade one is suitable for methane; grade two for certain organic vapours. No apparatus, strictly speaking, is available in group four, *i.e.*, hydrogen, carbon disulphide, or acetylene. For this group all lights and electric apparatus must be outside the workroom, the lights shining in through gas-tight windows.

Static Electricity Danger

Static electricity is a serious source of ignition. It is produced by the friction of belts on pulleys, the friction of solids in cyclones, friction of liquids on solids, etc. Ethylene oxide passing along glass tubes produces static electricity. No "static" occurs if the relative humidity exceeds 75 per cent and this method is extensively employed in the U.S.A. In England, the emphasis is almost entirely on earthing, although even a very efficiently earthed vessel may still suffer. In the dry-cleaning industry a fire has occurred by sparking when a dress covered with tinsel was being removed from the cleaning vessel. Bolted flanges on metal pipes must be provided with a bonding strip; the latter must make a good electrical contact. Belts and pulleys are sometimes protected by earthed brushes and combs, but even so it is claimed that half the "static" can be missed. The most efficient method of earthing is the use of conducting belts.

The lecturer then dealt with ways of minimising the effects of the explosion. There is no method of controlling an explosion by diluting exploding substances, but cooling methods can be employed. Flames can be controlled by gauzes, but for explosions flame arresters must be used. These may consist of sheets of copper crimped between numbers of concentric cylinders, boxes containing pebbles to cool the gas, or even water may be used. Water as used in ejectors for removing fumes, *e.g.*, from varnish pots, acts as a flame arrester. In effect, flame arresters divide a plant into small units.

Details were given of a particularly interesting system used to collect ground mag-

nesium. The collecting vessel was connected by valve with a receiver sufficiently strong to withstand an explosion; the latter was again connected through a valve with another receiver on a lower floor. The floor between the last two vessels was very strong, and the valves were interconnected so that only one could be open at any time. In this way the lowest receiver on the floor occupied by the workman could not be directly in connection with the grinding machine. Where a continuous discharge is essential, a rotary valve having vanes may be used. With screw conveyors, if a portion of the screw is removed the solids will form a plug which arrests flame or explosion. If the screw is horizontal, a baffle across the top portion of the tube is necessary, as the plug may not fill all the tube. If the flame ignites the solid, there is some risk of this ignited material being carried forward by the screw and so causing an explosion on the other side of the plug.

Secondary Explosions

A bursting panel, after it has completed its function of relieving pressure, may allow air to pass into the vessel, so causing a secondary explosion. This can be overcome by a self-sealing door. The earlier types were too heavy to be satisfactory, and caused resistance to the explosion, as they had to be opened by the explosion. Recent types are made of a very light construction, are kept open and released after the bursting panel has functioned, and they fall back on to a soft seal. The bursting panel should give a release area of 5 sq. ft. per 100 cu. ft. for organic materials, and 10 sq. ft. per 100 cu. ft. for aluminium or magnesium powders.

For aluminium settling chambers and for cyclones, brittle asbestos cement is used. This materials rests on inverted T beams and is fixed with non-hardening bitumen. In the case of cyclones, the reliefs must be in both the top of the cone and the outlet pipes. Explosions have occurred in which the outlet pipe having a relief had been flattened and then the cone, which had no explosion relief, had burst. In ducting, flame arresters may not be a complete protection and in these cases the ducting should join at right angles in the form of a cross and bursting panels should be fitted at the openings opposite the ducts. When an explosion occurs, the relief ducting itself builds up pressure by reason of the inertia of the air, and reliefs should be fitted every 15 ft.

Elevators are difficult subjects, but one method employed is to build a recess in the outside wall and erect the elevator in this recess; the latter is then outside the building. All bursting panels should be in a safe place, or preferably be followed by a duct leading outside the room. These ducts must be examined frequently to ensure freedom from blockage as the bursting panel may perforate slightly and leak dust into the duct.

A special system employed when grinding diazo compounds was then described. Each grinding machine was erected inside a room having three very strong walls, and one wall and roof made of brittle asbestos cement. Opposite the weak wall, a blast wall was built. One door was constructed to give access from the workroom. This door opened inwards so that if an explosion occurred the wall would support the door. A special key was used both to start the motor (the starter being in the workroom) and to lock the door. The key would not be removed from the starter when the machine was running, or from the door unless the latter were locked.

During the discussion which followed it was stated that no explosion had occurred during the grinding of zinc, but one could occur with the very fine dust met with when zinc was distilled; also, carbon black had never caused an explosion. The lecturer said with regard to pipes containing solvent it was desirable for these to be below ground level, but the duct must be of impervious material, otherwise leaking solvent would enter the ground and might reappear some considerable distance away. It was also mentioned that in some works the apparatus was being constructed of very strong materials capable of withstanding the pressures obtaining when an explosion occurred. These pressures are about 100 lb. per sq. in. Strong relief pipes, about 6 in. diameter, are attached to the apparatus to allow the pressures to fall to normal. These pipes are fitted with bursting panels.

New Control Order

Copper and Zinc Selling Prices

THE Control of Non-Ferrous Metals (No. 25) Order (S. R. & O. 1946, No. 1821), increases the maximum prices at which copper and zinc may be sold in the United Kingdom. Maximum prices are increased per ton as follows: Copper, by £14; zinc, by £5; zinc sheets, by £5; zinc oxide, by £4. Holders of valid licences to purchase copper and zinc metal (as sold by the Directorate of Non-Ferrous Metals), granted on or before November 12, 1946, may, on application to the Directorate at 20 Albert Street, Rugby, cover themselves by purchases, where they have not already done so, against such licences up to and including November 30, 1946, at the maximum prices ruling on November 12, 1946. Inquiries should be addressed to the Directorate of Non-Ferrous Metals, 20 Albert Street, Rugby.

Developments in Electrometric Analysis

Some Aspects of Physical Methods

A COMBINED meeting of the Cardiff and District Section of the Royal Institute of Chemistry, the Physical Methods Group of the Society of Public Analysts, and the South Wales Section of the Society of Chemical Industry was held recently at the University College, Cardiff, when three papers were presented. Mr. R. C. Chirnside, F.R.I.C., chairman of the Physical Methods Group, occupied the chair, and the first paper was given by Mr. A. D. E. Lauchlan, M.A. (of the Cambridge Instrument Co., Ltd.) on "Recent Developments in Apparatus for *p*H Measurement and Electro-Titrations."

Mr. Lauchlan said that the use of the thermionic valve in a *p*H measuring device had enabled manufacturers to supply an instrument which was so robust and simple to use that even the unskilled and semi-skilled workers were now able to make precision measurements. One of the aims of the instrument maker had been to produce electrodes as robust as the associated instrument, and to this end thicker glass electrodes had been produced. Mr. Lauchlan pointed out that the difficulties of making stronger glass electrodes had not been in the actual blowing of the bulb but in the arranging of conditions so that the very minute amount of energy available could be applied to the measuring circuit without appreciable loss.

Advantages of Purity

It had been found that the best results were obtained if the glass was made from very pure materials, so that impurities, chiefly Al_2O_3 were kept down to as low a value as possible, generally 0.25 per cent. The production of pure glass enabled manufacturers to make very small electrodes which were yet sufficiently conducting to give theoretical results over the same range as the normal electrode. These small bulbs, which may be only 2.5 mm. in diameter, were exceedingly useful for examining small quantities of material or for carrying out electro-titrations on a few drops of liquid, such as might be used in a Conway vessel.

Probably the most outstanding improvement in glass electrode performance was the production of a glass which was less sensitive to sodium ions and enabled accurate measurements to be made up to *p*H 14, and in solutions stronger than N. The improvement in performance could be judged from the fact that the normal glass electrode had a sodium error of about 0.6 *p*H at 12 *p*H, whereas the new glass reduced this error to zero even on a solution of N. sodium ions. While it was necessary to know the sodium ion concentration in order to apply the appropriate correction to obtain the best results, the error introduced by an uncertainty of the ion concentration was not nearly so serious. The general accuracy of this new glass electrode was about 0.02 *p*H.

Simpler Apparatus Required

Mr. Lauchlan pointed out that in spite of the fact that the literature on potentiometric titrations extended back over a considerable number of years, there did not seem to have been any great application of the methods until the last war. Possibly the need for a large number of routine analyses to be carried out by semi-skilled workers proved the need for a simpler apparatus than had been available before. The earlier forms of electro-titration apparatus, developed mainly by Dr. Sand, were rather akin to some of the earlier *p*H meters and did not lend themselves to easy operation or understanding by the semi-trained. The use of the hydrogen electrode, with all its attendant troubles, no doubt accounted for its lack of popularity.

Mr. Lauchlan expressed the opinion that the so-called "magic eye" indicator had not so far replaced the galvanometer in English *p*H meters as had already happened in some cases in America, probably because the range of valves suitable for convenient incorporation in the instrument were not yet readily available here. The modern galvanometer and the "magic eye" were now competing for the place of detector, and here, at any rate, the "magic eye" seemed to have an advantage since it could be mounted on the burette stand. The slightly lower sensitivity of the "magic eye" detector was not so important here as, unless the conditions of the reaction going on in the beaker were not well chosen, there should be a reasonably large change of potential at the end-point. He thought, however, that he might be permitted to remind the user that, no matter how good the instrument may be, the best results could not be obtained unless the conditions of the chemical reaction were properly arranged, for the indicator electrode could only pass on to the detector the result of the change which it experienced in the reaction.

The second paper was given by Mr. R. J. Carter, B.Sc., of the I.C.I. Paints Division, Research and Development Department, Slough, and dealt with "Some Applications

of Electrometric Methods to analysis." Mr. Carter reviewed a few of the more useful electrometric methods available for use in quantitative analysis, and some new trends in analytical research prompted by those methods. He illustrated his lecture with a number of graphs, and confined his references to potentiometric titrations divided into sub-groups of acid-alkali, precipitation, and oxidation-reduction types, concluding with some considerable reference to the mechanism and application of the Karl Fischer reagent electrometric method for determining small amounts of water.

Acid-Alkali Titrations

Dealing first of all with the acid-alkali titrations, he pointed out that the relative ultimate accuracy of indicator and potentiometric methods largely depended upon the appearance of inflection in the neutralisation curve. In general, the latter is governed by the magnitude of the product KC relative to the ionisation constant of the solvent, where K is the ionisation constant of the weak acid or base and C is the concentration constant of the solvent. Apart from the obvious application to titrations of coloured solutions, the use of the potentiometric method was of value where the indicator end-point was evanescent, such as with weakly dissociated acids or bases, a practical example being heavily bodied vegetable oils. The reaction towards the end of the titration may be slow, requiring some time for a steady e.m.f. reading at each addition, but the graphical calculation of the equivalent point would be accurate and would give a result truer than that obtained with an indicator.

Coming to the precipitation and oxidation-reduction type titrations, Mr. Carter said the use of electrolyte bridges in potentiometric titrations where a bimetallic system could not be employed quite often had the disadvantage of the risk of contaminating the test solution. Polarisation end-points provided a type of titration which was finding increasing use. A characteristic feature was the rapidity with which the system reached an equilibrium at each addition of titrant near to the end-point as opposed to the pause usually necessary with orthodox potentiometric end points.

The importance of the Karl Fischer reagent as a quantitative reagent for the determination of small amounts of water was evident from the volume of published work on this subject. It would appear that the applications were almost without limit, and in fact, foundation for further work in the quantitative analytical organic field had been truly established by the work of Smith, Bryant, and Mitchell. They had utilised the production or use of water in a number of organic reactions as a means of estimating organic radicals.

Karl Fischér had suggested the use of an electrometric end-point where the visual titration was not possible, and later Almy, Griffin, and Wilcox had described the potentiometric back titration of excess Fischer reagent with a standard water solution using a platinum-tungsten electrode pair. Disadvantages were the usual wait until equilibrium was reached after each addition and the need for resensitising the tungsten electrode.

In the third paper of the evening on "Polarisation End Points" Dr. D. P. Evans, Ph.D., M.Sc., pointed out that the advantage of the use of polarised electrodes in certain titrations were the remarkable accuracy coupled with simplicity and cheapness of the apparatus; its usefulness in coloured or turbid solutions; and the rapidity at which readings could be taken.

The use of polarised electrodes in the titration of thio-sulphate with iodine was fully described in order to illustrate the method. A small potential of about 15 m.v. (smaller than the maximum back e m.f. developed) was applied to two platinum wire electrodes immersed in acidulated thiosulphate solution. The solution was mechanically stirred. Owing to the reducing action of thiosulphate the anode was completely depolarised and the back e.m.f.—which becomes immediately equal to the applied voltage—is due entirely to polarisation of the cathode. Addition of some iodine caused a momentary excursion of the galvanometer spot from the zero position, but this was rapidly regained, owing to the redevelopment of the back e.m.f. At the end-point the galvanometer spot was permanently displaced in the direction required by the condition: applied e.m.f. $>$ back e.m.f.

Ensuring Accuracy

A definite condition for accuracy—more especially in weak solutions of the order of 0.002 N.—was that there must be sufficient reducing agent present throughout the titration to keep the anode depolarised. In the titration demonstrated by Dr. Evans this was ensured by adding some iodide ions as potassium iodide.

The method has been applied, said the lecturer, to give an expeditious method for determining dissolved oxygen in boiler-feed water. He referred students to Evans and Simmons (*J.S.C.I.*, 1944, *63*, 29-30). It might also be used for determining chlorine in domestic water supplies. Polarisation and depolarisation of an "inert" electrode had also been employed to measure chlorine in drinking water by the automatic recorder. In the fall in potential due to the depolarisation of a cathode by the dissolved chlorine, a current is caused to flow through a resistance, and the fall in potential along this resistance was proportional to the chlorine contained in the water.

Technical Exhibition

Chemical Displays in Kelvin Hall, Glasgow

THE Technical Exhibition which was opened in the Kelvin Hall, Glasgow, on November 15 and will remain open from 10 a.m. to 8 p.m. daily until Wednesday, includes a number of interesting displays by firms closely concerned with the chemical industry.

The Mirrlees Watson Co., Ltd., chemical engineers, have a display of steam-operated air ejectors, including carbon-lined types of ejectors, manufactured in conjunction with the Morgan Crucible Co., Ltd., for dealing with corrosive gases and vapours. They also show de-aerators and pumps for water, milk, corrosive fluids, oils, greases, and similar units. The allied company, Blairs, Ltd., of Glasgow, show a model of a continuous three-column alcohol still for the production of high-strength neutral alcohol from molasses.

Lewis Berger (Scotland), Ltd., who are hoping shortly to expand their Scottish plant, in Glasgow, to cope with increased business, show Kemplastite, Hy-Meg, and Dimenso finishes. The immense advances in electrical insulation involving the use of superior varnish finishes is stressed in the exhibits on show here. Marconi Instruments, Ltd., have a considerable range of electronic instruments for measurement of industrial conditions, perhaps the most important from the chemical viewpoint being the pH meter, a mains-operated type for determination of pH content in solutions in use in a wide range of industries. The Morgan Crucible Co., Ltd., show a wide range of newer uses of Morganite carbon, including bearings, valves, rings, reamers, dies, and moulds, utilising the chemical inertness and heat and shock resistance qualities of the material for application in fields far removed from the more generally known electrical field.

The stall of Benn Brothers, Ltd., at the Technical Exhibition, Glasgow.

Parliamentary Topics

German Scientists

IN the House of Commons this week, Mr. Mayhew, in reply to a question by Mr. T. Reid, said the subject of the deportation of Germans to the U.S.S.R. from the Soviet zone of Germany had been actively discussed at all levels of the quadripartite machine in Berlin and, as it had been impossible to reach agreement, the whole question had been referred to the Allied Control Council.

Mr. Gammans asked the Minister of Supply whether the German scientists who had come to this country were engaged on a voluntary agreement and what were the terms of that agreement.

Mr. Wilmot: The agreements, which are entirely voluntary, offer employment to these scientists for six months in the first instance and are subject to renewal by mutual agreement. The contract may be terminated earlier on compassionate grounds or for other reasons at the department's discretion. The salaries offered are graded according to qualifications.

Sulphate of Potash

Asked by Mr. Medlicott if he were aware of the shortage in supplies of sulphate of potash available to commercial fruit-growers and if he would arrange for some allocation at an early date, the Ministry of Agriculture said he was aware of the shortage and regretted it was unlikely that supplies would be sufficient to make allocations, whether of sulphate or other forms, this season.

Mr. Medlicott further asked if the Minister were not aware that a certain amount of potash was at present being produced in the British zone of Germany, the greater part of which went to Holland, and whether he could not arrange for some proportion of this to be allocated to the U.K.

The Minister doubted whether potash produced in Germany was going to Holland. "We are doing all that we can do to improve supplies," he added.

Streptomycin Tests

A question was addressed to the Lord President of the Council by Colonel Crosthwaite-Eyre, who asked what provision had been made by his department for research into the use of streptomycin and whether any money had been allocated for research production of this drug.

Mr. Morrison's reply was that the Medical Research Council had arranged for controlled clinical trials of streptomycin, as soon as supplies were available, to determine its value in tuberculosis and other conditions, and the best method of its use. Funds were being allocated for this work, including the making of purchases.

Egyptian Patent Law

An Interesting Proposal

A MODERN patent law has been drafted in Egypt and it is expected that it will be enacted soon, states a pamphlet on industrial developments and commercial conditions in Egypt, which has been prepared, with special reference to patent, design and trade mark matters, by F. Lysaght, of Lysaght & Co., Patent and Trade Mark Attorneys, P.O.B. 1795, Cairo.

It is expected that the new law will provide for the grant of patents for a term of 15 years, subject to the payment of annual renewal fees. It is probable that, during the first few years, the Egyptian authorities will not make an official search and examination as to the novelty of inventions before granting patents, and that they will limit their investigation to that of examining specifications as to the clarity of the descripton of the invention to be patented.

At present, and until the new law comes into force, the protection of inventions and designs in Egypt is secured by registrations effected in the Mixed Court of Appeal, and there is no doubt that the existing rights of the owners of these inventions will be recognised under the proposed new legislation, by granting them facilities to apply for a patent under the new law with priority rights as from the date of filing, in the Mixed Court of Appeal, of the original application for protection of the invention.

Pending the coming into operation of the new patent law, it is essential that new inventions should continue to be protected by registration in the Mixed Court of Appeal, because the prior use or publication of an invention in Egypt, before the date of filing an application for a patent under the proposed new law, will prevent the grant of a valid patent being obtained.

New designs for pattern, shape or configuration of articles will continue to be protected by registration effected in the Mixed Court of Appeal, and a new statute law for the protection of industrial property will, it is assumed, be enacted within the next year or two.

Perhaps best known as drum manufacturers, Todd Bros. (St. Helens and Widnes), Ltd., have published an informative and readable booklet covering another side of their output—their chain products. In addition to details of the firm's products in this line, text and pictures are included introducing both the works where they started manufacturing in 1859 and where they still produce their hand-made chains and the department where their electrically-welded steel chains are made.

German Technical Reports

Some Recent Publications

SOME of the latest technical reports from the Intelligence Committees in Germany are detailed below. Copies are obtainable from H.M. Stationery Offices at the prices stated.

BIOS 550. Investigation of beryllium production in Germany, and Italy, including production and uses of oxides and alloys (10s. 6d.).

BIOS 654. Lead-zinc copper mining in the Harz and lead-zinc mining in the Ruhr coalfield (23s. 6d.).

BIOS 657. German laboratory porcelain industry (1s. 6d.).

BIOS 697. Fire protection of oil installations in Germany (4s.).

BIOS 758. *I.G. Hoechst*: Manufacture of crotonaldehyde and crotonic acid (6d.).

BIOS 773. *I.G. Farbenfabrik, Wolfen*: Manufacture of photographic developing substances (3s.).

BIOS 775. *I.G. Hoechst*: Manufacture of butanol, methoxybutanol, butyraldehyde, and glycerogen (2s.).

BIOS 790. *Krupp A.G., Essen*: Armour plate: Notes on gas carburising process (1s.).

BIOS 791. *Interrogation of Dr. H. Roelig*: Dynamic properties of rubber (6d.).

BIOS 792. *Interrogation of Dr. P. Stocklin*: Properties and testing of rubber (1s. 6d.).

BIOS 800. *Interview with Dr. Becker*: Chemistry of polymerisation as applied to the preparation of Buna synthetic rubbers (1s. 6d.).

BIOS 805. Aspects of the synthetic fatty acid and synthetic fat industries in Germany (11s.).

BIOS 818. Notes on German iron and steel foundries, including centrifugal casting (3s. 6d.).

BIOS 820. Tungsten carbide: Notes on Krupp Widia plants (4s.).

BIOS 825. Steelmaking: Notes on German practice (7s. 6d.).

BIOS 826. Investigation of German researches on fine structure of metals, with special reference to X-ray diffraction techniques (2s.).

FIAT 299. Supplemental report on the Ruhrel Hydrogenation plant, Welheim, Ruhr (1s.).

FIAT 387. German steel casting industry (13s.).

FIAT 430. Survey of the soda ash and caustic soda plants of Western and Southern Germany (2s. 6d.)

FIAT 447. Study of production of shale oil from shale in Wurttemburg (9s.).

FIAT 617. Electrical and technical ceramic industry (13s.).

FIAT 655. Synthetic sapphire and spinel production (1s. 6d.).

FIAT 706 Report on selenium dry rectifier developments (5s.).

FIAT 733. Vertical retort zinc and by-products (3s.).

FIAT 744. Salicyclic acid (1s.).

FIAT 789. Experiments to produce ductile silicon (1s.).

FIAT 798. Titanium metal produced by Degussa and Osram (1s.).

Non-Ferrous Scrap Metals

Latest Prices

THE Ministry of Supply has issued a list of selling prices of non-ferrous scrap metals at Ministry of Supply depots, where sales will be held when sufficient material of the quality required is available. The list refers to delivery until the end of February and is published without prejudice or commitment. Inquiries regarding the list should be addressed to Directorate of N.F. Metals (Scrap Disposals Department), 41-43 Norfolk Gardens, London, W.C.2.

The following is a summary of the prices per ton of the various classes of scrap listed: Copper—scrap, £88 10s. to £91 10s.; turnings, £80. Zinc—scrap, £44. Brass—scrap, £62 10s. to £76 10s.; turnings, £63 10s.; 70/30 metallics, £57 10s.; 60/40 rod swarf, £56 10s.; 60/40 broken down fuse scrap, £65 10s.; 90/10 gilding metal scrap, £82 10s. to £85; 95/5 cap metal webbing, £86. Scrap bullet envelopes—cupro-nickel, £90 10s.; gilding metal, £71 10s.

K.I.D. EXEMPTIONS

The Board of Trade is now giving consideration to the question of renewing the Safeguarding of Industries (Exemption) (No. 4) Order, 1946, under which exemption from Key Industry Duty until December 31, 1946, applies to certain chemicals and chemical substances, a complete list of which was published in THE CHEMICAL AGE on August 24 last (*see* p. 236). Any communications in reference to this matter should be addressed to the Industries of Manufactures (General) Division, Board of Trade, Millbank, London, S.W.1, before December 9.

Developments in the processing of vegetable and animal oils and fats are of particular interest to-day, and the London Aluminium Co., Ltd., Westwood Road, Witton, Birmingham, has given special attention to designing improved types of refining and deodorising plants for handling these products. Information about these plants is given in List No. D.O.15, while another recent publication, List No. V.S.14, describes vacuum stills.

Plan For A Port

Development of Kingston-upon-Hull

GENERALLY speaking, the chemical industry is more likely to be interested in the lay-out of a trading estate than in the broader planning of a town. With the growth, however, of the chemical export trade, the future of our ports becomes of increasing importance to the industry, a fact which becomes more strongly emphasised when the port has a close and long-standing connection with the chemical industries. This applies quite distinctly to the port of Hull, where the seed-crushing and vegetable-oil industries are old-established, and where the paint and general chemical industries have been expanding for some time past.

Hull is the third port of England, and although it suffered a particularly vicious and prolonged series of attacks from the enemy during the war, it never ceased to maintain the advantages it would have as soon as conditions became normal. Now, its active citizens have produced a plan for the future, prepared for the City Council by the late Sir Edwin Lutyens and Sir Patrick Abercrombie. It would be difficult to find two greater authorities on the subject, and the plan they have prepared is worthy of them and their capable assistants. It is published by the Hull firm of A. Brown & Sons, Ltd., at the price of 15s.—a most moderate figure.

New Industrial Plan

When examined alongside other schemes for the future of our battered British cities, the Hull plan is outstanding for clarity and excellent production. For obvious reasons, this is no place to publish a full review, but our readers' attention should be called to the section on industrial development and zoning. As in most other cities that grew rapidly in the 19th century, the industries of Hull, though partly concentrated in certain areas, are also, in large part, distributed throughout the residential areas, to the detriment of both industry and residents. The new plan sweeps away these isolated factories, and increases the available industrial areas by way of compensation. It is refreshing to note that such considerations as the disposal of effluents and the prevailing direction of wind (especially when volatile gases have to be thought of) have met with due attention. Still more agreeable is the amount of attention that has been paid to the amenities, not only in the preservation of the surrounding countryside—a safety-valve for the workers—but also by the creation of urban open spaces in key positions now incongruously occupied by industry.

The production of such a volume is a difficult task, especially in these times, and it has been well carried out. The one fault we would find is that the name of that distinguished geographer, Professor Rudmose-Brown, has been consistently mis-spelt.

Iron and Steel Output

U.K. Figures again show Increase

PRODUCTION of pig iron and steel in the U.K. during October again showed an increase over the previous month's figures. Pig iron output was 623,200 tons, equivalent to a rate of 8,101,600 tons a year, compared with 584,400 tons (annual rate, 7,598,200 tons), for the same month last year. Steel production, in spite of fuel difficulties and limitation of transport, was 1,017,200 tons (annual rate, 13,226,000 tons) compared with 972,800 tons (annual rate, 12,648,000 tons) for October, 1945. Figures given in the tables below represent tons.

PIG IRON

	1945 *Weekly Average*	1946 *Weekly Average*
First quarter	134,500	145,500
Second quarter	132,600	150,500
Third quarter	132,600	146,600
September	139,300	147,300
October	146,100	155,800

STEEL INGOTS AND CASTINGS

	1945 *Weekly Average*	1946 *Weekly Average*
First quarter	233,200	242,600
Second quarter	227,200	252,100
Third quarter	211,300	230,000
September	240,700	238,500
October	243,200	254,300

WELDING MEMORANDA

A series of Welding Memoranda has been published by the Ministry of Supply as follows: No. 1, Specifying Welds on Drawings and the Control of Arc Welding Procedure; No. 2, Welding of High Tensile Steels; No. 3, Jigs and Manipulators for Fusion Welding; No. 4c, Resistance Welding Processes; No. 5, The Replacement of Drop Forgings and Pressings by Welded Parts; No. 7, Inspection of Arc Welded Work; No. 8, Inspection and Control of Quality of Spot Welds in Mild Steel; No. 9, Brazing; No. 10, Testing Arc and Gas Welders; No. 11, The Design of Welded Joints. Copies of each publication are obtainable from H.M. Stationery Office (price 6d.).

A CHEMIST'S BOOKSHELF

Protective and Decorative Coatings, Vol. V: Analysis and Testing Methods.
Edited by J. J. Mattiello. London: Chapman and Hall, pp. ix + 662. $7.00.

This volume, which consists of five sections, each prepared by experts in their own particular fields, is concerned with the analysis of resins and plastics, drying oils, metal finishes and pigments. None of these fields presents an easy task to the analyst, and while much has been published in recent years on these topics, it is inconveniently scattered throughout the literature.

The first chapter deals with the analysis of resins, both natural and artificial. In view of opinions often expressed as to the impossibility of analysing any sample of a plastic less than 10 or 15 g., as contrasted with the minute amounts frequently demanding identification in industrial practice, it is interesting to note that this chapter is the work of two "analytical microscopists," who may be presumed to be undaunted by the difficulty of working with small amounts. These writers, making full use of microchemical techniques, indicate how far one can get with purely analytical methods, that is, those not involving actual microscopy.

Modern analysis can make much use of physical methods such as refractive index determination, or the investigation of ultraviolet and infra-red absorption spectra. Such methods are adequately covered in addition to the normal chemical processes. There is a wealth of information, which gives particular weight, because of space limitation, to the methods found most useful by the authors in practice. There is, in addition, a sufficient set of references to the more important literature of the subject.

The second chapter is concerned with the analysis of drying oils, once more an exceedingly complex field for the analyst. Here also full details are given for the most useful physical and chemical determinations which will aid, on the one hand, in the identification of an unknown oil, or, on the other hand, in the routine control of a manufacturing process.

In Chapter III we have a description of methods available for the laboratory testing of metal finishes for outdoor service. The methods of preparing test panels, the subsequent treatment, and the assessment of results are all clearly covered.

The spectral characteristics of pigments in the visual and infra-red regions—the range 4000 to 9000 A.—form the subject matter of Chapter IV. After a description of the methods employed in measurement of the spectra, a comprehensive list of data is given for a wide range of commercial pigments. This includes, among other information, the chemical nature and formula, the spectrophotometric curve for the pigment, and classifying methods which will aid towards its recognition.

Finally, the last chapter describes the application of the microscope in the examination of plastics. The methods of preparing samples, where necessary in the form of sections, and the requisite information about the use of the microscope, are comprehensively dealt with. The chapter is copiously illustrated with photomicrographs and other illustrations portraying a wide range of materials and the interpretation of their appearance under the microscope. This chapter forms a valuable supplement to the more orthodox chemical and physical methods of Chapter I.

To any analyst whose work may include the fields covered in this book, this is an essential reference work. It is full of useful information, it is finely produced and printed, and the many illustrations are above criticism.

C. L. WILSON.

Plastics in the World of Tomorrow.
By Captain Burr W. Leyson. London: Paul Elek (Publishers), Ltd. Pp. 85. 10s. 6d.

The title of this book is self-explanatory and its main aim is to give those interested nowadays in the future potentialities of a developing new industry a survey of the shape and design of thousands of domestic and industrial articles to be made in plastics. It is written for the industrialist as well as for the layman and for young people looking for promising careers in this new industry. Part One is devoted to this, whereas Part Two deals with characteristics and industrial uses of the principal plastics. The subsequent three parts of the book describe plastics in the aircraft industry and the fabrication and other special uses of plastics. Thus the potential user is provided with adequate data which will give him at any rate the preliminary indications as to what specific plastics would serve his purpose. A brief review is provided of available technical literature. An appendix gives a list of trade names of materials dealt with in the text and in the 43 illustrations of this useful and commendable guide.

The pumping and elevating of corrosive liquids has been a speciality of the Kestner Evaporator & Engineering Co., Ltd., for many years. A great advance in acid pump manufacture is represented in the pumps now being produced by the company, these being not only glandless, but self-priming. Full details are given in the company's latest publication Leaflet 269a, "Pumps for Corrosive Liquids," copies of which are obtainable from the offices at 5 Grosvenor Gardens, Westminster, London, S.W.1.

A Chemical Centenary

The late Mr. Peter Spence, founder of Peter Spence & Sons, Ltd., of Manchester and Widnes. The company's centenary is being celebrated this month.

BRITISH COLOUR MAKERS

At the recent annual general meeting of the British Colour Makers' Association, the following were elected for the ensuing year: *Chairman*, Mr. S. K. Roberts (I.C.I., Ltd., Dyestuffs Division); *Vice-chairman*, Mr. H. G. Ferguson (Cornbrook Chemical Co., Ltd.); *Hon. treasurer*, Mr. C. G. A. Cowan (Cowan Brothers (Stratford), Ltd.); *Council*: Mr. S. K. Roberts (I.C.I., Ltd., Dyestuffs Division), Mr. H. G. Ferguson (Cornbrook Chemical Co., Ltd.), Mr. K. Burrell (J. W. & T. A. Smith, Ltd.), Mr. V. Watson (Cromford Colour Co., Ltd.), Mr. H. A. Wilson (Derby-Oxide & Colour Co., Ltd.), Mr. A. H. Orchard (Golden Valley Ochre & Oxide (Colours) Co., Ltd.), Mr. C. L. Lewis (Joseph Storey & Co., Ltd.), Mr. J. Crombie (James Anderson & Co. (Colours), Ltd.) (immediate past chairman), Mr. C. G. A. Cowan (Cowan Brothers (Stratford), Ltd.; *Secretary*, Mr. Allan J. Holden, B.Sc., F.R.I.C.

Manchester Oil Refinery, Ltd.

Manchester Oil Refinery, Ltd., announce that certain staff appointments within the company have been adjusted as follows: *general manager*, Mr. E. J. Dunstan, M.Sc., F.Inst.Pet.; *refinery manager*, Mr. J. C. Wood-Mallock, F.Inst.Pet., M.I.Gas E.; *secretary*, Mr. H. L. Morris. The managing directors are Dr. F. Kind, Ph.D. (Vind.), M.I.Pet. Tech., and Dr. G. Tugendhat, LL.D. (Vind.), M.Sc. (Econ.) (Lond.).

Personal Notes

DR. W. IDRIS JONES, F.R.I.C., director of research for the Powell Duffryn Co., has been appointed director-general of research for the National Coal Board.

PROFESSOR E. K. RIDEAL, F.R.S., Fullerian Professor of Chemistry, Royal Institution, is among the new members appointed by the Chancellor of the Exchequer to the University Grants Committee.

DR. D. C. MARTIN, general secretary of the Chemical Society, is to succeed Mr. J. D. Griffith Davies as assistant secretary of the Royal Society.

DR. W. H. GARRETT, production director to Monsanto Chemicals, Ltd., has been appointed a magistrate for the Ruabon district. He is vice-chairman of the Association of Chemical and Allied Employees, and for 15 years has been a member of the Chemical Trade Joint Industrial Council

DR. J. B. SUMNER, of Cornell University, has been awarded the first half of this year's Nobel Chemistry Prize for his discovery of the crystallisability of enzymes. The second half of the Prize has been awarded jointly to DR. W. M. STANLEY and DR. J. H. NORTHROP, both of the Rockefeller Institute for Medical Research, Princeton, for researches into the purified production of enzymes and virus proteins.

MR. J. DAVIDSON PRATT, director and secretary of the Association of British Chemical Manufacturers, is a member of a British trade mission which has gone to Austria to investigate the possibilities of co-operation between British and Austrian industry and the speeding up of the economic recovery of Austria. Other members are MR. N. E. ROLLASON, of the British Iron and Steel Federation, and MR. H. L. STUBBS, of the British Non-Ferrous Smelters' Association.

Following the recent appointments by Monsanto Chemicals, Ltd., of MR. J. V. HEAD, as assistant purchasing manager, and of MR. W. M. THOMPSON, as home sales manager, the company has announced the reorganisation of its home sales department. MR. D. C. M. SALT, who has been with Monsanto for nearly twelve years, is now manager of the heavy chemical department in place of Mr. Head, and will be responsible for the sale of phenol, cresols, and similar products. The fine chemical department will be under the management of MR. J. S. M. DASHWOOD, B.Sc., A.R.I.C.

Obituary

PROFESSOR WILLIAM HENRY ROBERTS, who was Liverpool City Analyst for 34 years before his retirement, has died at Liverpool.

General News——From Week to Week

The Gas Light and Coke Co. is planning to spend £10,000,000 on new plant in the next five years.

A Welsh Industries Fair is to be held in London for the first time, at the Royal Horticultural Halls, Westminster, from January 1-7.

The Royal Society announces that applications for Government grants for scientific investigations must be received before November 30.

The resumption of trading relations between Great Britain and Hungary for the first time since the war was announced on Monday in an official statement issued by the Board of Trade.

The primary vesting date for the transference of the coal mines to national ownership is to be January 1 next, according to a statement made by the Minister of Fuel in the House of Commons on Monday.

A phial of the new drug, streptomycin, was among the exhibits at the London Medical Exhibition held this week in the Royal Horticultural Society Hall, Westminster.

The Chemical Council's telephone number is REGent 2714-5, not REGent 1675-6, as stated in THE CHEMICAL AGE last week, the latter being the new number of the Chemical Society.

Courtaulds announce that their offer has been accepted for a site for a new viscose rayon fabric factory at East Haven, 15 miles from Dundee. It is hoped eventually to employ 1000 people there.

A Mining and Metallurgical Committee has been appointed by the Royal Anthropological Institute to investigate problems of early metallurgy as part of its scheme for group studies of the evolution of man.

The Royal Institute of Chemistry is asking the Privy Council to approve an alteration of the Institute bye-laws to enable it to hold future annual general meetings in April instead of in March as has been customary.

Uranium ore from the Belgian Congo has arrived at Liverpool. Contained in 1300 drums, and weighing more than 860 tons, it arrived on the Elder Dempster ship *Fulani*. The ultimate destination of the uranium is secret.

The Johnson Matthey Dramatic Society is presenting its second post-war play, "Death Takes a Holiday," at St. George's Hall, Tottenham Court Road, London, on the evenings of December 5, 6 and 7. Seats may be booked by telephoning Holborn 9277.

The address of Technical Products, Ltd., has been changed to 112, Strand, London, W.C.2. (Tele.: TEMple Bar 4455; Telegrams: "Tecproduct, London"). A North of England office has been opened at 4, St. Mary's Parsonage, Manchester, 3. (Tele.: Blackfriars 0097)

The recent opening of the Dublin office of Burroughs Wellcome & Co., at 18, Merrion Square, was celebrated by a dinner at the Royal Hibernian Hotel, Dublin, attended by the Lord Mayor and by leading members of the medical, dental, veterinary and pharmaceutical professions in Ireland.

More than 70,000 German civil patent specifications, covering war-time developments in German industry and research, have been brought to Britain from the Berlin Patent Office and are open to inspection at the Patent Office Library, 25 Southampton Buildings, Chancery Lane, London, W.C.2. The specifications are in German. Photographic copies may be obtained at the rate of 6d. per page.

A trade delegation from Hungary has recently been in Britain discussing a renewal of trade between the two countries within the framework of the payments agreement lately concluded. Members saw representatives of British firms and trade organisations. Hungary can supply goods, including possibly manufactured goods, and the question of Britain and the sterling area exporting raw materials as well as goods was considered.

Potassium iodide has been added to Vitamin A and D tablets for expectant mothers. According to a Ministry of Food announcement, this addition has been made on the recommendation of the Standing Committee on Medical and Nutritional Problems and the Goitre Sub-Committee of the Medical Research Council. Each tablet will contain 0.13 mg. potassium iodide in addition to 4000 I.U. Vitamin A, 800 I.U. Vitamin D and 250 mg. B.P. calcium phosphate.

New light industries for Scotland are promised by the announcement that United States, Swedish, Dutch and Italian firms have been granted permission to set up factories there for the manufacture of such lines as cash registers, tractors, car accessories, light electrical equipment, radios, clothing and typewriters. A total of more than 120 firms, including some from the Midlands and Southern England, are establishing factories in Scotland, according to the Scottish regional commissioner of the Board of Trade.

British manufacturers of plastics will be represented at the 1947 British Industries Fair in much greater numbers than in former years, according to the *Board of Trade Journal*. Moulding powders and presses used in the production of plastic goods, also a varied display of finished articles, will be exhibited. This section is being organised in co-operation with the British Plastics Federation. The Fair will be held at Olympia and Earls Court, London, from May 5-16.

The problem facing scientists today, said Professor W. F. K. Wynne Jones, of University College, Dundee, speaking to the Royal Philosophical Society of Glasgow on "Freedom and Organisation in Science," was whether they were free or not to carry on experimenting when they found a phenomenon that might be a positive menace to mankind, such as the atomic bomb. It was impossible now for the scientist to sit back and say "I have no responsibility for my actions."

Despite less unemployment in the development areas, the number of people employed in Britain—20,400,000—was nearly a million fewer than in June, 1945, mainly because of married women leaving industry, stated the Minister of Labour at a trade union conference in Edinburgh last week. He said he expected the number to fall by a further 400,000 by the end of this year. Unemployed in the development areas had declined in number by 10,000 in the past month, but had risen over the country as a whole.

A new edition of the *Raw Materials Guide*, outlining the procedure for obtaining supplies and for effecting imports and exports of various raw materials, including a large number of substances used in the chemical industry, besides plastics and non-ferrous metals, has been published by the Board of Trade. It provides a summary of the current Statutory Rules and Orders affecting the commodities covered and the information is complementary to that given in THE CHEMICAL AGE YEAR BOOK. Copies of the Guide are obtainable from H.M. Stationery Office (1s. 6d.).

Imperial Chemical (Pharmaceuticals), Ltd., announce that the marketing of their products in Southern England is now being conducted through the I.C.I. regional and area offices in London and Bristol. All correspondence from South-East England should now be addressed to: Imperial Chemical (Pharmaceuticals), Ltd., Gloucester House, 149, Park Lane, London, W.1, (Tele: Grosvenor 4020; telegrams: Chemind, Telex, London). Correspondence from the western area should be addressed to: Imperial Chemical (Pharmaceuticals), Ltd., Eagle House, Colston Avenue, Bristol. (Tele.: Bristol 20051; telegrams: Impkemix, Bristol).

Foreign News

Deposits of vanadium have been discovered in Kazakhstan.

An Argentine national five-year plan includes expenditure of 620 million pesos for oilfields.

An "electronic brain" is reported to have been constructed by the Electrotechnical Institute of the Soviet Union.

A new element, curium 242, the heaviest substance yet known, has been produced in the U.S.A. by bombardment of platinum with alpha particles.

Because of the shortage of vegetable oils in the Union of South Africa, the Department of Agriculture is taking steps to increase the production of groundnuts.

Expected to produce 350,000 tons of ammonium sulphate a year, the proposed fertiliser factory in Bihar, India, is now "well under way," it is officially reported.

UNRRA has purchased 15,000 tons of artificial fertiliser in the Soviet Russian zone of occupation of Germany, to be distributed to Austria, Czechoslovakia and Yugoslavia.

With the completion of experimental alumina operations, the Columbia Metals Alumina plant at Salem, Oregon, U.S.A., is to be devoted to the production of sulphate of ammonia at a rate of 200 tons a day.

The Brazilian Petroleum Council has been accorded authority to set up a limited liability company to be styled "Refineria Nacional de Petróleo," for the purpose of refining national petroleum.

The Austrian mining authorities have decided on a radical reorganisation and intensification of the whole mining industry, especially coal and iron ore, mainly by way of offering premiums for production.

The sugar refinery at Enns, Upper Austria, has resumed production again with more than 700 workers. Following a very good sugar-beet harvest, output is regarded as very promising.

Italian interests have offered 3000 flasks (76 lb. each) of mercury in the New York market at a c.i.f. price of $83.50 per flask, as compared with the American quotation of $96 to $99 per flask, free New York.

Several new schemes are projected for the Indian Council of Scientific and Industrial Research, including atomic research; research on nuclear physics; and preparation of tannic acid from myrobalans.

Russian whaling plans are reported to have aroused much interest in Oslo. Swedish machines have been installed in a Russian floating factory and the Russians have repaired German catchers. It is believed likely that the Russians will catch in the Antarctic next season.

Forthcoming Events

November 25. Institution of the Rubber Industry. Engineers' Club, Manchester, 6.15 p.m. Mr. Maldwyn Jones: "The Impact of Plastics on the Rubber Industry."

November 25. Royal Institute of Chemistry (London and S.E. Counties Section). The College, High Street, Acton, W.3, 7.30 p.m. Scientific film show.

November 26. Royal Institute of Chemistry (London and S.E. Counties Section). The County School, Isleworth, 7.30 p.m. Scientific film show.

November 26. Society of Public Analysts (Physical Methods Group). Chemical Society's Rooms, Burlington House, Piccadilly, London, W.1. Mr. J. T. Stock, Mr. Airey, Dr. C. J. O. R. Morris: "Polarographic Analysis."

November 27. Institute of Welding. Institution of Civil Engineers, Great George Street, Westminster, S.W.1. Mr. E. Fuchs, Dr. L. Mullins, Mr. S. H. Smith: "The Inspector's Approach to Radiographs of M.S. Butt Welds."

November 27. Society of Chemical Industry (Food Group, Microbiological Panel). Chemical Society's Rooms, Burlington House, Piccadilly, London, W.1, 6.15 p.m. Mr. H. C. S. De Whalley and Miss M. P. Scarr: "Micro-organisms in Raw and Refined Sugar and Intermediate Products."

November 28. Royal Statistical Society (Industrial Applications Section) (Sheffield Group). The University, Sheffield, 1, 6.30 p.m. Mr. D. Newman: "The Efficiency of 100 per cent Inspection."

November 28. Royal Institute of Chemistry (Liverpool and North-Western Section) (jointly with S.C.I., Chemical Society and B.A.C.). The University, Liverpool, 7 p.m. Mr. A. V. Billinghame: "The Development and Industrial Application of Wetting Agents."

November 29. Royal Institute of Chemistry (Cardiff and District Section) (jointly with S.C.I.). University College, Cathays Park, Cardiff, 7 p.m. Dr. D. T. A. Townend: "Recent Developments in Combustion."

November 30. Institution of Chemical Engineers (North-Western Branch). College of Technology, Manchester, 3 p.m. Mr. K. A. Sherwin: "The Concentration of Caustic Soda Solution."

December 2. Society of Chemical Industry (London Section). Chemical Society's Rooms, Burlington House, Piccadilly, London, W.1, 8 p.m. Dr. N. O. Clark: "Foams and Fire Fighting."

Company News

The nominal capital of **Anglamol, Ltd.**, 6 Booth Street, Manchester, has been increased beyond the registered capital of £1000, by £9000, in £1 ordinary shares.

The **Beecham Group** announces a second interim of 8½ per cent on its deferred shares, on account of the year ending March 31 next, compared with 7½ per cent. The total distribution for 1945-46 was 36 per cent, including a victory bonus of 4 per cent. The present payment will bring dividends for the current year to 17 per cent to date, against 15 per cent at this time last year.

New Companies Registered

Chemical and Manufacturing Products, Ltd. (423,184).—Private company. Capital £1000 in £1 shares. Subscribers: J. Solsona, 42 Kenton Road, Harrow (first director); E. Ashing; Rodriguez Gyrmko.

Sales Products Research & Development Co., Ltd. (423,380).—Private company. Capital £1000 in 1s. shares. Manufacturing and analytical chemists, etc. Directors: E. C. Thorne, J. C. Clark. Registered office: 514 Ipswich Road, Trading Estate, Slough.

H. S. Walker and Co., Ltd. (423,295).—Private company. Capital £3000 in £1 shares. Manufacturers of and dealers in chemical and other preparations, etc. Directors: Hugh S. Taylor, John F. Murphy, Roy Cuzner. Registered office: 170 Kensington High Street, London, W.8.

Chemical and Allied Stocks and Shares

POLITICAL uncertainties have again had a curbing influence on stock markets, and British Funds became less firm with industrial shares reflecting a little profit-taking. Home rails were adjusted to the compensation values proposed by the Government, but the latter came in for considerable criticism as not being fair to stockholders because there is a strong case for the question of compensation being decided by an independent tribunal. Iron and steels, after responding to the industry's latest production figures, eased in accordance with the general market tendency, and colliery shares attracted less attention following the announcement of January 1 as the vesting date. Later, there was a good deal of selling of home rails for reinvestment in industrial shares.

Chemical and kindred shares were not immune from the uncertain trend of markets, Imperial Chemical easing to 42s. 10½d.

but later improving to 43s. 4½d., while Fisons were 57s. 9d., Burt Boulton 26s. 9d., although B. Laporte remained at 98s. 1½d. Greeff-Chemicals Holdings 5s. ordinary were 12s. 6d., Monsanto Chemicals 5¼ per cent preference 23s., and Stevenson & Howell 5s. ordinary 30s. 6d. xd. Lever & Unilever firmed up to 48s. on the full results, and Turner & Newall were steady at 86s. 6d. awaiting the dividend announcement. Unted Molasses moved up to 55s., while the units of the Distillers Co. were 136s., the interim dividend being due shortly. Borax Consolidated at 47s. 3d. showed firmness, higher dividend hopes persisting for the financial year ended September 30. Barry & Staines improved to 55s, British Glues & Chemicals 4s. ordinary held their rise to 17s. and the participating preference shares moved up to 46s. British Match displayed firmness at 50s., British Aluminium have been steady at 44s. 9d., and British Oxygen were 101s. 3d., but following the annual meeting, Triplex Glass 10s. ordinary receded to 35s. Among paint shares the tendency became steadier with Lewis Berger higher at £6 15/16 on the company's new factory plans and on hopes of an increase in the pending dividend. Following the dividend increase, Imperial Smelting firmed up to 20s. 3d. xd. De La Rue eased to £13¼, but elsewhere, General Refractories were favoured up to 20s. 3d.

Among iron and steels, gains predominated on balance, although best levels were not held. Guest Keen, after 45s. 9d., eased to 45s. 3d., United Steel were 26s., and Ruston & Hornsby 62s., while Babcock & Wilcox rose to 67s. 6d., but later eased to 67s. Powell Duffryn strengthened to 26s., but colliery shares generally became less active. Associated Cement eased to 67s. British Plaster Board were 32s. 6d. on the unchanged interim. Shares considered to have bonus prospects attracted rather more attention on renewed hopes that the ban on share bonuses may be modified. Vickers, and Qualcast were among shares to improve in this connection, but earlier gains were not fully held.

Boots Drug strengthened to 61s. 3d. also helped by talk of future bonus possibilities. Beechams deferred were good at 26s. 10½d. xd. on the higher interim payment, Timothy Whites were 45s. 6d., Sangers 33s. 9d., and Griffiths Hughes strengthened to 61s. In other directions, Tube Investments have rallied to £6⅝ xd on further consideration of the past year's results. British Drug Houses receded to 55s. 9d., and textiles were less firm, although on balance, Lancashire Cotton Corporation ordinary have recorded a good rise, awaiting the forthcoming dividend. Dunlop Rubber at 70s. 9d. lost a few pence, but later rose to 72s. 6d. Oil shares became less firm, with Shell 90s. 7½d., Anglo-Iranian 95s. 7½d., and Burmah Oil 67s. 6d. C. C. Wakefield showed firmness around 70s. on talk of a second interim dividend.

British Chemical Prices

Market Reports

THE London industrial chemicals market has been without feature this week, although a strong undertone has been displayed in most sections, with prices showing an upward tendency. The call from users for deliveries under existing contracts has covered good volumes, and demand generally continues steady, with many orders both for home and export still to be placed. The potash and soda products sections are mainly unchanged, with supplies of a number of items continuing tight. Conditions in the coal-tar products market show little change on the week. Pressure for contract deliveries is the chief note and a firm price position is maintained.

MANCHESTER.—Fresh inquiries on the Manchester chemical market during the past week have again included a fair number on export account and no lack of new business in the general run of heavy products is available. In a number of instances, however, the supply position is tight and is becoming increasingly so. In these circumstances it is less easy to arrange firm delivery dates. The soda compounds generally are in good demand and a steady absorption of supplies of the general run of potash chemicals as offers are made is reported. A ready outlet from the mineral acids is a feature of the market. With an odd exception there is a brisk demand for the coal-tar products, both light and heavy, and new buying interest is strongly in evidence.

GLASGOW.—A heavy demand has been experienced in the past week for all materials available for delivery, and orders for forward delivery have been on the late scale. There is the usual activity in synthetic detergents and soap substitutes and a strong demand for whiting, formaldehyd, Glauber salts, Epsom salts, DDT insecticides, soda ash, caustic soda, etc. The supply position has shown no sign of improvement and prices remain very firm, with a tendency to rise, as in the case of copper sulphate and zinc oxide. In the export market conditions were again very active and considerable business has been accepted for magnesium sulphate, copper sulphate, sulphuric acid, caustic soda, soda crystals, hydrofluoric acid, zinc oxide, and a large range of tanning chemicals, textile chemicals, and other raw materials. In this market also prices remain very firm.

Price Changes

Charcoal: Lump, £24 per ton. Granulated, £30 per ton, on rail.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Coating magnetic materials.—British Thomson-Houston Co., Ltd. 31263.

Cathode-ray tubes.—British Thomson-Houston Co., Ltd. 31260.

Cathode-ray tubes.—D. A. G. Broad. 30991.

Insecticides.—S. P. Cantero. 31157.

Imidazolines.—Ciba, Ltd. 30820-21.

Manufacture of fuel.—C. J. Coleman. 31133.

Metal coatings.—W. T. Davies, H. E. Gresham, and M. A. Wheeler. 30861.

Flocculation of solids.—De Directre Van de Staatsniynen in Limburg, Landelend Voor en Namens den Staat der Nederlanden. 31128.

Crystalliser heating apparatus.—F. B. Dehn. (Stearns-Roger Manufacturing Co.) 31243.

Aqueous dispersions.—E.I. Du Pont de Nemours & Co. 30759.

Acetylenic hydrocarbons.—E.I. Du Pont de Nemours & Co. 31061.

Plastic compositions.—E.I. Du Pont de Nemours & Co. 31062.

Synthetic latex.—B. F. Goodrich Co. 30647.

Organic compounds.—B. F. Goodrich Co. 30648.

Aromatic carboxylic acids.—B. F. Goodrich Co. 30649.

Trichloroethane.—B. F. Goodrich Co. 30780.

Halomaleate copolymers.—B. F. Goodrich Co. 30781.

Organic compounds.—W. H. Groombridge. 30854.

Hydrogenation, etc., production.—J. J. R. Guichard. 31214.

Hydrocarbon conversion.—Houdry Process Corporation. 31244.

Triazines.—R. M. Hughes. (J. R. Geigy A.G.) 30756.

Dehydroanthracene derivatives.—R. H. Hughes. (J. R. Geigy A.G.) 30757.

Resinous products.—International Plastics, Ltd., V. E. Yarsley, and C. A. Minois. 31191.

Purifying agents.—L. M. Jencsa, and J. Polasek. 31234.

Brazing, etc., alloys.—R. C. Jewell, and Sheffield Smelting Co., Ltd. 31102.

Toxic organic compounds.—M & P. Colloid Stabilisers, Ltd., and J. May. 31094.

Contacting liquids with gases.—N.V. de Bataafsche Petroleum Maatschappij. 30720.

Crude tar distillation.—Newton, Chambers & Co., Ltd., and L. S. Brown. 30848.

Chemical reactions.—Oreal Soc. Anon. 31226.

Soap purifying.—Oreal Soc. Anon. 31227.

Oxygen diffusers.—L. Orlow. 31241.

Organic compounds.—H. F. Oxley, and E. B. Thomas. 30853-55.

Recovery of silver from solutions.—Permutit Co., Ltd. 30697.

Recovery of metal from solutions.— Permutit Co., Ltd. 30698.

Synthetic resins.—L. N. Phillips. 30809.

Plasticisers.—G. F. Rayner. (American Viscose Corporation.) 30761.

Synthetic waxes.—C. T. Richards. 30613.

Organo silicon resins.—Westinghouse Electric International Co. 30651.

Sheer plastics.—F. C. Wybrew. 30862.

Bonded granular articles.—A. Abbey. (Carborundum Co.) 31514.

Condensation products.—Algemeene Kunstzijde Unie N.V. 31613-4.

Alloys.—Alloy Research Corporation. 31459.

Treatment of hydrocarbon mixtures — C. Arnold. (Standard Oil Development Co.) 31961.

Hydrocarbon polymers.—C. Arnold. (Standard Oil Development Co.) 31962.

Catalysis of organic products.—D. Balachowsky. 31469.

Plastic coating of materials.—F. Begley, and L. Begley. 31317.

Thermo plastics.—F. Begley, and L. Begley. 31318.

Concentration of latex.—British Rubber Producers' Association, Ltd. (J. H. Pidford.) 31884.

Boron compounds.—British Thomson-Houston Co., Ltd. 31379-80.

Organoboron compounds.—British Thomson-Houston Co., Ltd. 31753.

Organic compositions.—California Research Corporation. 31387.

Alkali metal selenides.—California Research Corporation. 31388.

Sulphur compounds.—California Research Corporation. 31389.

Tungsten alloys.—Callite Tungsten Corporation. 31508.

Purification of water.—Carbonisation et Charbons Actifs. 31478.

Penicillin.—Carbonisation et Charbons Actifs. 31479.

Complete Specifications Open to Public Inspection

Centrifugal separation of sludge-containing liquids.—A/B Separator. April 18, 1945. 10758/46.

Preparation of culture or fermentation liquors to be used as a medium for obtaining industrial products.—Bioquimca Española Soc. Anon. April 17, 1945. 30155/45.

Volatiliser of liquids.—P. Bokor. April 19, 1945. 11704/46.

Mixtures of polyoxyalkylene diols.—Car-

bide & Carbon Chemicals Corporation. April 21, 1945. 11604/46.

Method for alcoylating aromatic hydrocarbons.—Compagnie Française de Raffinage. April 18, 1945. 20734/46.

Evaporation of water from concentrated solutions of calcium nitrate.—Directie Van de Staatsmijnen in Limburg. Nov. 17, 1941. 27771/46.

Removal of fluorine from acid nitrate containing solutions.—Directie Van de Staatsmijnen in Limburg. June 5, 1942. 27772/46.

Production of acid calcium phosphates and of calcium nitrate from raw phosphate and nitric acid.—Directie Van de Staatsmijnen in Limburg. Sept. 5, 1942. 27773/46.

Production of calcium phosphate.—Directie Van de Staatsmijnen in Limburg. April 4, 1941. 27774/46.

Cyclic process for producing dicalcium phosphate by reacting raw phosphate with phosphoric acid and hydrolysis of the reaction mixture.—Directie Van de Staatsmijnen in Limburg. April 30, 1942. 27775/46.

Protection of metal surfaces.—E.I. Du Pont de Nemours & Co. June 15, 1943. 11355/44.

Preparation of interpolymers.—E.I. Du Pont de Nemours & Co. April 21, 1945. 11831/46.

Production of chromable azo dyestuffs.—J. R. Geigy A.G. April 17, 1945. 11664/46.

Pyrylium dye salts as filter and anti-halation dyes in photographic materials.—General Aniline & Film Corporation. April 17, 1945. 12234/46.

Manufacture of aqueous dispersions of synthetic linear polyamides.—I.C.I., Ltd. April 20, 1945. 11828/46.

Preparing fertilisers.—Produits Chimiques du Limbourg S.A. April 19, 1945. 10873/45.

Preparation of metallisable polyazo dyestuffs.—Sandoz, Ltd. April 16, 1945. 11662/46.

Processes for producing products containing copper oxychloride.—Sirco A.G. April 19, 1945. 11046/46.

Textiles dyed with vat dyestuffs.—Soc. of Chemical Industry in Basle. Jan. 6, 1943. 175/44.

Inhibition of oxidation and like deterioration in hydrocarbons.—Standard Oil Development Co. Dec. 31, 1942. 16567/43.

Curing olefine-diolefine copolymers.—United States Rubber Co. Jan. 15, 1944. 20808/44.

Manufacture of methionine.—U.S. Industrial Chemicals, Inc. April 17, 1945. 34960/45.

Manufacturing ferrous bodies containing silicon.—American Electro Metal Corporation. April 28, 1945. 8693/46.

Methods of preparing silicone resins.—British Thomson-Houston Co., Ltd. Feb. 12, 1944. 3253/45.

Formation of solutions of polymeric materials.—E.I. Du Pont de Nemours & Co. June 23, 1943. 11946/44.

Coating of fabrics.—E I. Du Pont de Nemours & Co. April 27, 1945. 12643/46.

Dyes and particularly photographic sensitising dyes.—E.I. Du Pont de Nemours & Co. April 28, 1945. 12650/46.

Therapeutically active hydrazo-compounds containing arsenic radicals and process of preparing same.—E. A. H. Friedheim. Oct. 31, 1942. 17747/43.

Production of monoazo dyestuffs.—J. G. Geigy A.G. April 26, 1945. 12494/46.

Polymerisation of methyl methacrylate in the presence of aliphatic, thiols.—I.C.I. Ltd. March 20, 1943. 5138/44.

Vulcanising froth sponge.—I.C.I., Ltd. April 24, 1945. 11829/46.

Production of alkali metal perborate compositions.—I.C.I., Ltd. April 28, 1945. 12831/46.

Manufacture of amino-aldehyde adhesives.—I. F. Laucks, Inc. April 24, 1945. 10338/46.

Processing of oleaginous material.—Lever Bros. & Unilever, Ltd. April 26, 1945. 12613/46.

Apparatus for determining the vapour content of a gas.—A. D. Little, Inc. April 25, 1945. 7258/46.

Complete Specifications Accepted

Process for heat-treating and stretching untwisted yarn consisting of a polymer of acrylonitrile.—E.I. Du Pont de Nemours & Co. Aug. 20, 1943. 581,526.

Production of vinyl and ethylidene esters.—E.I. Du Pont de Nemours & Co. Sept. 24, 1943. 581,627.

Manufacture of fluorine-containing compounds.—E.I. Du Pont de Nemours & Co. Sept 24, 1943. 581,628.

Manufacture of organic fluorine compounds.—E.I. Du Pont de Nemours & Co. Oct. 4, 1943. 581,662.

Halogenomethyl derivatives of amido compounds.—E.I. Du Pont de Nemours & Co. Aug. 18, 1944. 581,517.

Alloys and articles produced therefrom.—W. Hartill. Aug. 28, 1940. 581,563.

Production of vinyl esters.—I.C.I., Ltd. July 28, 1943. 581,501.

Laminated articles comprising both glass and polymethyl methacrylate.—I.C.I., Ltd. Aug. 4, 1943. 581,507.

Manufacture of shaped structures from orientated halogen-containing polymers of vinyl and vinylidene compounds.—I.C.I., Ltd. Sept. 21, 1943. 581,620.

Preparation of antimony pentafluoride.—I.C.I., Ltd. Oct. 7, 1943. 581,666.

Separation of minerals.—R. G. Jackson, C B. W. Willson, and I.C.I., Ltd. Sept. 15, 1944. 581,610.

Treatment of cast iron for the reception of tin coatings thereon.—V. A. Lowinger,

and R. A. Cresswell. Dec. 10, 1043. 581,604-581,639.

Manufacture of compound sheet materials. —J. H. McGill, and I.C.I., Ltd Sept. 29, 1944. 581,651.

Bonding fabrics to natural and synthetic rubber.—T. J. Meyrick, J. T. Watts, and I.C.I., Ltd. May 8, 1944. 581,520.

Method of and apparatus for injection moulding of plastic materials.—H. G. W. Chichester-Miles. Dec. 11, 1944. 581,642.

Anodes for the electrodeposition of nickel. —Mond Nickel Co., Ltd., and L. B. Pfeil. Sept. 13, 1944. 581,549.

Seals between tungsten and boro-silicate glass.—M. C. Nokes. Sept. 11, 1944. 581,545.

Reclaiming of vulcanised synthetic rubber scrap.—J. Obloczynski, and North British Rubber Co., Ltd. Sept. 13, 1944. 581,589.

Chrome-tungsten-cobalt-molybdenum steel. —E. H. Schwarz. March 25, 1943. 581,571.

Acid-proof and heat-resistant steel.—E. H. Schwarz. March 25, 1943. 581,572.

Method of improving the physical properties of inorganic binding agents, mortar, and concrete.—Sika Holding A.G. Dec. 9, 1942. 581,489.

Process for the manufacture of furnaces for the electrolytic production of aluminium. —S A. Pour L'Industrie de L'Aluminium. Aug. 23, 1943. 581,625.

Aluminium alloy.—M. A. Wheeler. Sept. 8, 1944. 581,542.

Manufacture of vinyl halides.—Wingfoot Corporation. March 16, 1943. 581,573

Process of refining zinc oxides.—American Zinc, Lead & Smelting Co. Feb. 26, 1943. 581,840.

Thermo-setting resins.—British Industrial Plastics, Ltd., and A. Brookes. March 1, 1944. 581,702.

Coating of solid organic polymers with polysilicic acid esters.—E.I. Du Pont de Nemours & Co. April 22, 1943. 581,751

Aluminium base alloys.—High Duty Alloys, Ltd., and H. G. Warrington. April 6, 1944. 581,706.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV
No. 1431.

November 30, 1946

Annual Subscription 21s.
Overseas 26s.

The Apathetic Chemist

APATHY in politics is a characteristic of the British. We do not get excited about things and although we may think deeply about them, we do not always express our views. A "soul-satisfying" list of typical British qualities was published abroad by a well-known Italian Fascist during the Abyssinian war; it comprised "tea-drinking, snobbery, golf-playing, puritanism, clean-shavenness, pipe-smoking, bridge-playing, and inexplicable apathy towards women." It is not only the Italy of Mussolini that accuses us of apathy. The *Journal of the British Association of Chemists* repeats with obvious approval the charge that has been levelled against chemists—against British chemists anyway—that "as a body they are apathetic, individualistic, and unsociable." The cause of this animadversion was the recent voting in the Association upon the question of whether or not to affiliate with the T.U.C. Here we may say at once that the voting went against affiliation by a majority of 24 in a total vote of 1138. It is not the result, however, that worries the editor of the *Journal of the British Association of Chemists*; it is the fact that only 56 per cent of all the members voted upon so vital an issue. That has given rise to the editorial reflection that "nearly half the members seemingly did not care a hoot about the destiny or policy of their association, and yet possibly they join the cry, sometimes amounting to a chorus—'What's wrong with the B.A.C.?'" There is, remarks the editor, no smoke without fire, and much rhetoric is being expended to induce members of the profession of chemistry to rouse themselves.

There are many answers to this condemnation of the chemist, some are excuses, some are not so much answers as contributory factors which may help to account for the seeming indifference. It may be of interest to notice that a vote of 56 per cent does not in itself indicate any particular apathy on the part of the chemist over and above that displayed by other sections of the British public. Is the vote at local government elections any greater? Is the percentage voting at by-elections for Parliament any greater? Even at General Elections we have known the votes to be cast to be of that order of magnitude.

The vote, moreover, may be a true reflection of the opinion of the chemists of this country. The reasons for and against affiliation to the T.U.C. are nicely balanced and it is not necessarily true that either the advantages or the disadvan-

On Other Pages

tages are sufficiently marked to give rise to strong feelings about it; those who have no strong feelings are likely to abstain because there is present no force sufficiently great to overcome the inertia that exists in every British individual against writing and posting a letter. If we ourselves were puzzled about the rights and wrongs of an issue, should we vote one way or the other? We should not. Being reasoning human beings, we should desire that those who had studied the subject should make up our minds for us, and we should thus abstain on the ground that it is better that those who had views should express them. That may seem a negation of responsibility, but it has something to recommend it and at least shows faith in our leaders that they will take the right decision.

The chemist does not take too kindly to organised trade unionism. The B.A.C. held a Brains Trust which is reported in the same issue of the *Journal*. One answer to a question, as to why chemists do not readily co-operate to their own mutual benefit, deals with this issue fairly. The reply was to the effect that "the people who set out to be chemists were those who considered themselves to be more individualistic than those in other trades. . . . The chemist is an individualist. His apparent apathy to this question is very largely due to poor pay. But also it is not to be disregarded that being an individualist, the chemist more and more considers that he is less likely to be out of work. He has more confidence in himself than a worker in more stereotyped industry. That the chemist is an individualist is really the best answer of all." The individualist believes in standing firmly upon his own feet. The chemist is a member of the staff who expects one day to attain high position. That position may be as chief chemist, as chemical engineer, as head of some department where scientific knowledge can be put to some useful purpose, or even as general manager or managing director of the whole business. To the chemist there are open endless possibilities of advancement. A writer in an American magazine in 1940 asked and answered a question very pertinent to this discussion: "Where," he asked, "is the opportunity for the poor man to-day? Our land frontiers are gone!" His answer was: "This age is not an age of farming, but of science. New frontiers are being conquered to-day by new pioneers—our scientists, engineers, inventors, educators." The pioneers who opened the untamed West to human civilised occupation did not belong to a trade union, nor did they ask to become affiliated to any T.U.C. They fought and overcame by their own powers.

The chemist to-day is the pioneer of the brave new world that is being rather painfully hammered into shape. It is well to remind ourselves that there are other things in life besides preoccupation with material issues. Lord Dunsany, in his work, "Patches of Sunlight," has written: "We cannot add to the weight of the world by an ounce, we can only bring to it fancies; and whether they are expressed in towers by architects, or carved in jade by craftsmen in China, or written on paper by poets, it seems to me that they are the only wealth by which Earth can increase its store." The chemist and the physicist have found yet another way. They cannot, it is true, add to the weight of the world by an ounce, but they have discovered how to subtract from its weight, by the transformation of matter into energy. That in itself is as exciting an extension of the frontiers of the civilised world as ever was made by a gold rush or wild Western pioneer—Hollywood notwithstanding. Is it surprising that those who are making these and other advances through the discovery of natural phenomena should tie themselves down, label themselves as being workmen turned out to a single pattern, by taking trade union action?

We have given some of the answers to the charge of apathy. Do they add up to a decision not to join any such body as the B.A.C. or the Association of Scientific Workers or any other mutual benefit society? In our considered view they do not. The chemist may be starry-eyed; but he must be conscious of political movements that are going on around him. Technical and scientific men and women are the key personnel of the brave new world. Every Cabinet Minister who announces that he is about to nationalise something begs and prays for the help of the technical men in the industry concerned, for he knows that without their help he can do nothing. But the Cabinet, the government of this country is a highly organised body. Employers through their trade associations are highly organised. The main mass of non-professional workers—those who are described as receiving "wages" and not "salaries"—are highly

organised, and the demand for a closed shop has emphasised that organisation. The modern political conception is of large numbers of people engaged in roughly equivalent spheres of life being organised and deciding their terms of work and conditions of life by negotiation with other large organisations in other walks of life. The individualist, if he be very gifted, can walk alone, like Kipling's cat, "waving his wild wet tail in the wild wet woods" of the brave new world. But the ordinary mass of professional men, the general practitioners of medicine, of chemistry, of chemical engineering, cannot do any such thing. As well might each Britisher have stood alone to face the oncoming hordes of Hitler. In unity is strength and the sooner all professional men learn that lesson, the better it will be for them.

NOTES AND COMMENTS

NEW WORLD LIST

CHEMISTS will be pleased to hear that active preparations are being made for the issue of a third edition of the *World List of Scientific Periodicals*. The last edition of this invaluable scientific reference work, issued in 1934 and covering the years 1900-1933, is now out of print though still in constant demand. It contains upwards of 33,000 titles of journals and includes the holdings of some 180 libraries in Great Britain and Ireland. The new edition, which is designed to include all the scientific and technical periodicals that appeared during the period 1900-1947 as well as the holdings of additional libraries, will therefore be considerably larger. Librarians are being asked to co-operate as before by sending particulars of all those journals on their shelves that do not appear in the second edition or are shown there as having no location in this country. Information should be sent to the Secretary, World List of Scientific Periodicals, c/o The Zoological Society of London, Regent's Park, London, N.W.8, from which further particulars can be obtained.

PLAN FOR THE DONBAS

A CORRESPONDENT of *The Times* in the Ukraine, who has visited the great industrial Donbas region, has reported on the German destruction and Russian rehabilitation of this important coal-producing area. Nowhere, he says, was German destruction so systematic, and they set about their planned destruction of industry with incredible fury. Pits were flooded; and machines and even miners themselves were flung down the shafts. Thousands of electrical motors were removed and scarcely a single public building or residential block survived. When the Germans left, the population had shrunk from 3,000,000 to 1,500,000, and compared with pre-war figures the area was capable of producing only 6 per cent of its coal and 2.4 per cent of its pig iron. But in three years the reconstruction effort has been little short of miraculous and has taken the Donbas half-way back to normal. Of greatest interest in this struggle to rehabilitate one of Europe's principal industrial areas are the incentives offered to labour, and the emphasis laid on the provision of cultural amenities for the workers. Apart from the opportunities for rapid promotion, incentives take the form of an individual bonus for high output and a collective bonus for enterprises which attain the set figures. In some cases these bonuses have increased earnings four-fold. Each miner receives a daily bread ration of 1 kg. and a meal containing 100 gr. of fat before his shift. If the planned production is reached then he gets an extra 200 gr. of bread. A factor in the rehabilitation of the Donbas is the plan to erect a network of light industrial enterprises to produce most of the locally needed goods. It is believed production can be increased in this way and the manpower shortage overcome. The authorities expect that factories for stockings, shoes and clothes will be in mass production by 1950. According to the correspondent, there has been a tremendous moral effect in the Ukraine from the announcement in simple and unambiguous terms of the plan for this area.

TRADE WITH AUSTRIA

ONE of the conclusions reached by the British Trade Mission which went to Austria recently—as mentioned in THE CHEMICAL AGE last week—was that this country could render Austria real help in the giving of technical advice on modern production technique. Judging by the avidity with which the technical reports from the Intelligence Committees in Ger-

many are studied in certain quarters, we rather thought the boot might have been on the other foot. Mr. C. F. J. Ramsden, Overseas Director of the Federation of British Industries, who led the Mission, said the members felt that, taking the long-term view, the Austrian economy had considerable possibilities. Immediate difficulties, however, were great, and the Mission had directed its attention to ways and means of getting the ball rolling. In their individual inquiries members of the Mission discovered a number of bottlenecks which were holding up Austria's exports and ability to earn foreign exchange, and it is their hope that they might do something to ease these difficulties. They also felt that there were considerable possibilities of importing from Austria goods badly needed in this country, and propositions to this end would be put to their associations. Most of the members of the Mission—which included Mr. J. Davidson Pratt, director and secretary of the Association of British Chemical Manufacturers; Mr. N. E. Rollason, of the British Iron & Steel Federation; and Mr. H. L. Stubbs, of the British Non-Ferrous Smelters' Association—visited important factories in the provinces, and they were all unanimous in praise of the courtesy shown to them by the Austrians and the arrangements made for the Mission by the Economic Division of the British Element of the Allied Commission for Austria.

THE MODERN STUDENT

IN these columns last week we commented on a newspaper correspondent's dismay at finding among present-day university students far more earnestness than was usual in his (pre-war) university days. He thought the old light-hearted spirits and broad interests were disappearing, to be replaced by a spirit of austerity and even utilitarianism. Now Sir D'Arcy W. Thompson, Professor of Natural History at St. Andrews University, has come to the defence of the present-day students. In a letter to *The Times*, he gives it as his opinion that the modern urge for serious study is far better than what he termed the old "reluctant drudgery," which caused the lecture rooms to be half empty. He tells us that he now teaches 90 students, twice as many as before; but more important than mere numbers, he suggests, is the new spirit in the air. In other years the university reading rooms stood all day empty till terminal or degree examinations were at hand; now they are full and even crowded all day long. "In short it seems that reluctant drudgery has given place to studious industry." Sir D'Arcy Thompson believes that the young men and women ex-Service undergraduates have had time during their few years in the Forces to shake off the "paralysing and stultifying" influence of the schools. Schoolboys come up to college bored and stale; they have had too little encouragement to think, and too little opportunity to read; they have learned lessons and nothing more. He remembers when he left school for the university how he used to run to lectures, wondering what new and delightful things they would be shown that day. He now sees something of this happy, eager, curiosity again in young men and women who have begun to forget the schoolmaster's routine, and begun to taste the delights of learning.

MATURER MINDS

WE believe that Sir D'Arcy Thompson is right, but he has overlooked another important factor which makes for a more studious—and probably happier—life at the university. This is that these ex-Service men and women have matured, their minds have been enlarged and they can take full advantage of all the amenties, cultural, social and sporting which a university offers to them. And above all they can appreciate and really understand what they are learning. That, in our opinion, was the reason for the proposal put forward before the war, not to admit students to the university until they had been out in the world of commerce or industry for one or two years. We do not remember any suggestion then that students should enter the Services before going to the university, but it does appear from the present-day undergraduates that their Service life has broadened their outlook as much as would have been the case if they had gone into industry.

British Guiana's exports of balata between January 1 and August 31 this year were confined to the United Kingdom (374,611 lb.) and British possessions (900 lb.). The U.K. received no bauxite from the colony, although 29,894 lb. were exported to the United States and 647,260 lb. to Canada. One thousand bags of charcoal arrived in the U.K. here from British Guiana during the same period; and 1,887,397 gallons of molasses were among the colony's other exports to the U.K.

GERMAN USE OF LOW-GRADE FUEL WITH RICH OXYGEN

by D. D. HOWAT, B.Sc., Ph.D., F.R.I.C., A.M.I.Chem.E.

THE introduction in 1930 of the Linde-Frankl process for the production of oxygen made possible far-reaching developments in the utilisation of several types of low-grade fuels in Germany. Brown coal, containing 25 to 35 per cent of moisture, which occurs in extensive deposits in Germany, has been for years a real challenge to the German fuel technologists to perfect methods of efficient utilisation. A further spur to action arose from the adoption of the low-temperature carbonisation of brown coal and other low-grade fuels yielding tar for hydrogenation to petroleum and lubricating oils. The coke residues, with high ash content, are not suitable for many of the usual purposes and special methods of utilisation had to be investigated. There is little doubt, however, that the controlling factor in the progress which has been made has been the availability of relatively cheap and abundant supplies of oxygen from the Linde-Frankl plants. Without this the German fuel technologists would have experienced much greater difficulties. It is interesting to note that there is another close relationship between the supply of oxygen and the utilisation of low-grade fuels in that the greater part of the electric power requirements of the Linde-Frankl plants were met from power stations specially designed to burn these low-grade fuels.

Low Cost of Oxygen

Some picture of the vast scale on which these oxygen plants were planned may be obtained from the I.G. Farben plants at Leuna, where the total oxygen capacity was 829,000 cu. ft. per hour at 98 per cent purity. Over the five years from 1938 to 1942 actual output of oxygen averaged 770,000 cu. ft. per hour. Costs, in terms of British currency, were extremely low; power at 1.1 to 1.2 pf. per kWh was only about 0.2d., even taking the rate of 12 RM. equal to £1. This figure is only about one-third of the present day price in Britian. On the same conversion basis the cost of the oxygen at 1.6 to 2 per cent per cu. m. works out at only 1s. per 1000 cu. ft. If oxygen could be made available in this country at anything approaching these figures, many most attractive applications would become possible.

Whatever significance may be attached to the German cost figures, the magnitude of the utilisation of high purity oxygen is beyond doubt. In view of the outstanding progress made, it is imperative that considerable attention should be paid to this record of German achievement. The fuel situation in this country is sufficiently serious to justify the exploration of every possible way of utilising low-grade fuels. In the near future it may become necessary to consider seriously the treatment of pit bings for the recovery of fuel values. Many of these bings were laid down at a time when coal was plentiful and cheap and low-grade fuel commanded no market. A combination of crushing and concentration, say by rough flotation, may yield quite valuable revenues of fuel. Washery residues and sludges are another possible source of low-grade fuel. Finally, the relatively large deposits of peat in Britain, particularly in Scotland, must be regarded as a commercial asset. Lessons from the German methods of utilisation of brown coal may be of great value in this connection.

Water-Gas Production

For the present, only the gasification of low-grade fuels by oxygen will be considered in the light of the recent information available from Germany. The outstanding advances appear to centre in the use of an oxygen/steam mixture in place of the air/steam mixture commonly adopted. In the manufacture of water-gas, valuable both as a fuel and as the starting point for chemical synthesis, the great advantage of the process lies in the continuous production of gas from a generator in place of the cyclic "make and blow" process hitherto employed when utilising air in conjunction with steam. Gas produced during the "blow" period has a very low thermal value and is frequently vented to the atmosphere.

Two interesting and significant pieces of plant have been developed for water-gas production by using oxygen—the Winkler "boiling bed" generator and the "slagging" generator. Some of the main features of both these plants will be discussed.

High pressure gasification of fuel has frequently been proposed but the development by the Lurgi group of a high-pressure gasification process utilising oxygen and steam appears to constitute the first commercial success for a process of this type. Extremely useful information relating to this process has recently been made available and will be discussed briefly.

When oxygen and steam are blown through an incandescent bed of fuel the

oxygen content of the blast will largely determine the temperature of the fuel bed and, in consequence, the physical condition in which the ash is discharged. On this basis water-gas generators may be divided roughly into two types—the shaft generators, in which the oxygen content is maintained at a value insufficient to fuse the ash, which is discharged through the grate or carried over as "fly ash." On the other hand, in the "slagging generators" the

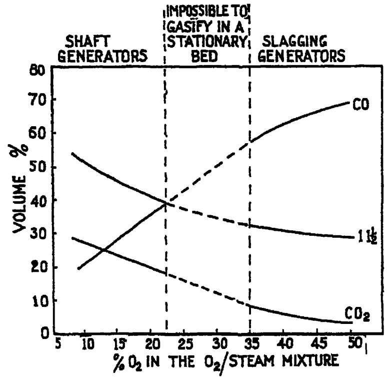

Fig. 1. Gas analysis as a Function of the oxygen content in the blast (Sabel).

oxygen content of the blast maintains a fuel bed temperature sufficiently high to melt the ash, which is tapped off as a slag. A complicating factor in this classification is the ash fusion temperature. With certain ash compositions it may prove very difficult to utilise an oxygen enriched blast without serious danger of clinkering and fusion occurring. Apart from this limiting factor the oxygen content of the blast is crucial in the continuous production of water-gas, as indicated in Sabel's data[1] in Fig. 1.

While the data given refer exclusively to stationary bed generators (and exclude the Winkler generator), it may be noted first that the upper limit of oxygen in the blast to a shaft generator is about 22.5 per cent. Sabel states that certain modifications of generator will give a low carbon in the ash with a high fuel bed temperature, even if the slag is beginning to soften. Then, as indicated in Fig. 1, with 22.5 to 35 per cent of oxygen in the blast it did not prove possible to gasify fuel satisfactorily in a stationary bed. With oxygen contents of over 35 per cent in the blast, slagging generators must be employed. The upper limit of oxygen (55 to 60 per cent) is reached with normal cokes and semi-ash. With these high oxygen contents the high fuel bed temperatures produced result in severe attack on the constructional materials of the generator.

Other important factors varying largely with the oxygen content of the blast are the quantities of steam consumed and the percentage of steam decomposition secured. As shown in Sabel's data in Fig. 2, the steam consumption decreases markedly with increase in oxygen content of the blast and with the higher fuel bed temperatures, yet the oxygen consumption per unit volume of ($CO + H_2$) is not increased. Further, as the steam decomposition increases with the oxygen content of the blast, the output of combustible gas per unit of shaft area also increases. In consequence, the aim is to carry as high an oxygen content in the blast as possible compatible with the life of the refractory lining of the generator.

By far the greatest volume of research and development work relating to the use of the oxygen/steam blast in water-gas production was carried out at the I.G. Farben plant at Leuna, where the first Winkler generator was installed in 1926.

The basic principle of the Winkler generator is not the use of an oxygen/steam blast but the employment of relatively small-sized particles of fuel to constitute a bed which is kept in suspension or "boiling" by a blast of air alone or a mixture of air and steam. Such a procedure would, it was claimed, result in a very greatly increased output of gas from a given area of hearth. At Leuna the original Winkler was planned to operate on particulate brown coal using the normal "make and blow" cycle with air and steam. Sabel[1] reports that the

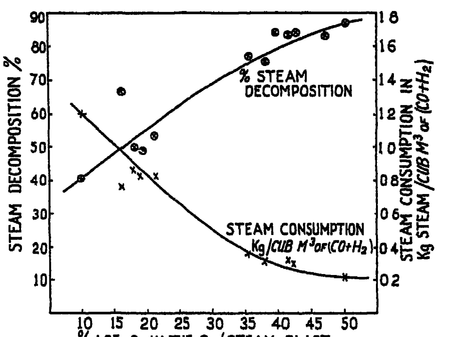

Fig. 2. Steam consumption and decomposition in relation to oxygen content of the blast (Sabel).

major difficulty in operating the Winkler generator on the "make and blow" cycle is the maintenance throughout the cycle of the correct velocity of air and steam so that the bed is maintained continually in suspension. Even comparatively small fluctuations in the velocities are troublesome, a decrease allowing the bed to become quiescent while

a small increase may result in blowing a large proportion of the charge up the chimney. Obviously, the difficulties of maintaining the correct velocity through the bed may be reduced if a continuous oxygen/steam blast is employed instead of the intermittent "make and blow" cycle. As a result of these difficulties, experiments directed to the utilisation of a continuous oxygen/steam blast, were started in Leuna in 1929.

A diagrammatic sketch of the Winkler generator finally developed is shown in Fig. 3.[3] As indicated in the diagram, the fuel is introduced into the fire bed by water-jacketed screw conveyors, three of which are provided on each generator, entry of the fuel being effected at a point about half-way up the fuel bed. Distribution of fuel within the bed is effected by the "boiling" action of the blast. Travelling chain grates, originally fitted, proved quite unnecessary and were replaced by stationary fire-brick grates. Damage to the fire brick by slag adhesion and the mechanical action of the stirrers made it necessary to substitute cast-iron bricks in the grates. A typical stationary grate is made up of wedge-shaped bars, 400 mm. long, 125 mm. deep, 35 mm. wide, packed in groups of three, a 1.5 mm. space being left between each group of three bars. Adequate distribution of oxygen and steam was secured by this arrangement.

Immediately above the grate a water-cooled stirrer arm rotates at about 1 to 2 r.p.m., the main function of the stirrer being to sweep larger pieces of ash and clinker towards one or two specially prepared holes in the grate. Discharged through the grate, the pieces of clinker are withdrawn from the generator by two water-cooled screw conveyors. Ash withdrawn by this means represents about 10 to 20 per cent of the total ash in the fuel feed and carries 30 to 50 per cent of carbon. The remainder of the ash is carried over by the gas produced as "fly ash." The entire grate assembly, comprising the grate, the stirrer mechanism, the wind-box, and the conveyors, may be disconnected from the generator, dropped on to a bogie and removed to the maintenance shop for repair and replacements. A spare grate is then inserted.

Grateless Generator

It is reported that a grateless generator has been developed at Leuna, but detailed information is not available. Apparently the base of the generator is made in a conical form, oxygen and steam being introduced through tuyeres fitted about half way up the cone. No stirrer is provided, ash discharge being secured by two screw conveyors in the base, the conveyors being run intermittently.

It is claimed that the grateless generator effected a saving of 10 per cent in both oxygen and fuel consumption for the same production of gas.

The depth of fuel in the "boiling" bed is maintained at 1 to 1.5 m., being controlled by the rate of addition of fresh fuel. Fuel feed control is manual, the operator working to the pressure difference across the fire-bed, this difference being proportional to the depth of fuel. Maintenance of the correct depth of fuel bed is extremely important as, with a fall in level, oxygen may "break through" into the water gas with serious danger of explosion in the pipe lines. Too thick a bed causes an excessive pressure drop, with the danger of the bed becoming quiescent. With a quiescent bed excessive ash fusion on the grate occurs.

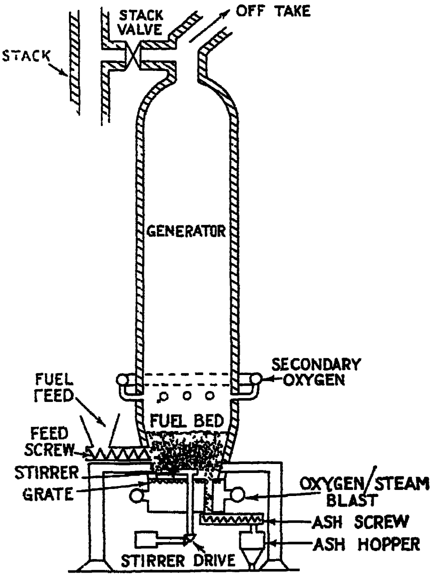

Fig. 3. Modern type of Winkler generator at Leuna (BIOS FINAL REPORT 333).

Fuel bed temperatures are maintained as high as possible to minimise carbon dioxide formation, but the attainable temperature is fixed by the fusion point of the ash, which usually sets the upper limit at 900 to 1000°C. Temperature control is exercised by adjusting the proportions of oxygen and steam in the blast.

Adequate mixing of the oxygen and steam is essential to successful operation of the Winkler generator and it is recommended that the mixing should be effected at a point in the pipe line at least 10 to 15 m. distant from the generator, preferably incorporatng a restriction plate or bend in the line. Failure to secure good mixing

causes increased local heating on the grate with excessive clinker formation. Permissible oxygen content in the blast may vary from 20 to 50 per cent.

Secondary oxygen added above the fuel bed, as shown in Fig. 3, serves two purposes. First, it helps to burn off some of the finely divided fuel particles blown out of the bed along with the "fly ash." Second, it raises the temperature of the gases so that cracking of the tars and hydrocarbons may occur together with further reaction between excess steam, carbon dioxide, and finely divided fuel. The fraction of the total oxygen blown in above the fuel bed may vary from 10 to 33 per cent. Steam may also be blown in at this zone, but in smaller ratio than in the blast underneath the grate.

The volume of the generator above the fuel bed is important, as it governs the time available for completing the reactions outlined above. Normally, the volume of generator space is about 15 times that of the actual fuel bed, giving an actual contact time between gas and suspended fuel particles of the order of 7 seconds. In the original type of Winkler generator the top was constructed in a bulbous fashion, but all the later types have been made straight-sided but of appropriately greater height, so simplifying the construction.

Gas Control

Water cooling must be provided on the tuyeres through which the secondary oxygen is blown in and the gas velocity must be controlled within very close limits to prevent the intensely hot flame damaging the brickwork opposite, or around, the tuyeres.

As a result of this design, the gases leave the generator at a rather higher temperature than that of the fuel bed, average gas outlet temperature varying from 950° to 1050°C. In addition, the exit gases carry about 80 per cent of the total ash in the fuel feed as "fly ash," while unburned carbon also escapes with the exit gases, the total amounting to 20 to 50 per cent by weight of the feed.

Provision is therefore made to secure waste-heat recovery and to precipitate "fly ash" from the gases. Exit gases from the generator pass downward through a long brick-lined pipe—a characteristic feature of the installation—to the waste-heat boiler. Water-tube boilers are employed raising super-heated steam at about 260 lb. pressure, the lower drum being insulated and hung in the gas space. After passing over the boiler tubes, dropping in temperature to 400°C., the gases flow through an economiser. In view of the dangers of erosion, the gas speeds through the boilers and economisers should be maintained below 8 m. per second. The weight of steam generated is at least equal to the weight introduced into the generators but, as the steam from the waste-heat boilers is at high pressure, it may be used as a source of power before being exhausted at a pressure of 10 to 25 lb. to the generators.

Dust removal is effected by multicyclones through which the gases pass after leaving the economisers. Electrostatic precipitators have been tried out at several plants, but these have apparently proved less efficient than the multicyclones, which are now standard equipment at all the installations. Even with high dust contents of 1400 grains per 1000 cu. ft., the multicyclones have proved to be 80 per cent efficient. Passing through a small water-seal (purely a safety measure) the gases are fed to water-scrubbers and then to Thyssen disintegrators, the dust content of the exit gases being 0.8 to 2.0 grains per 1000 cu. ft.

Profit and Loss

Ten to 14 per cent of the total carbon charged to the generator escapes with the "fly dust," which, over a year, was found to have the following analysis: carbon 54.3 per cent, ash 43.8 per cent, and C.V. 5000 T cals. per ton. This material is normally employed as a boiler fuel. Apparently the price of this fuel is sufficiently low for the loss of this percentage to be accepted with equanimity, provided a reasonable credit is obtained for its use as boiler fuel.

The exact economics of the Winkler generator are not easily assessed, first, because there is nothing in this country comparable to the two main fuels utilised—dry brown coal and "grude coke" (the product of low-temperature carbonisation of brown coal). The price of brown coal is 1 to 3 RM. per ton, while the cost of dried brown coal is 4 to 9 RM. per ton. It is estimated that the marginal "grude coke," utilised in the Winklers, was taken at the value of the cheapest alternative fuel, *viz.*, dried brown coal at 4 to 9 RM. per ton. As duff, washery slurry, and coke breeze, the cheapest available fuels in this country at the present time, are commanding 27s. to 33s. per ton, fuel costs would be at least twice those obtaining in German practice. The other very uncertain feature is the price of oxygen, which in this country is 8 to 12 times the German figures. In this connection, Sabel,[1] states that the price of water-gas (based on the CO plus H_2 content), made from hard coke when using oxygen gasification, is approximately 10 per cent higher than when using the normal "make and blow" method. The saving in coke effected by the use of oxygen and the simpler plant for continuous gasification does not balance the cost of the oxygen required—at the present price of oxygen, *viz.*, 1.2 to 2.0 pfennig per cu. m. (approximately 1s. per 1000 cu. ft.).

Also, when all the gas is to be converted

to hydrogen, the total steam requirements are higher, adding another cost item to the total. This factor is clearly shown in Sabel's calculations, converted into British units and shown in Table III (*see* p. 668).

A further disadvantage of the Winkler generator is the heavy capital cost involved in the provision of a liquid air plant for the supply of oxygen. Arising in this connection is the question of gas production per unit area of site. At two of the newest German installations the total site area involved—including fuel handling, waste-heat boilers, coolers, etc., but excluding the air liquefaction plant—was about 50 sq. m. per 1000 cu. m. per hour of CO plus H_2 (approximately 17 sq. yd. per 1000 cu. ft.) of installed capacity. In comparison, a coke water-gas plant operating on the conventional "make and blow" cycle would require a very similar area—roughly 14 to 20 sq. yd. per 1000 cu. ft. of gas.

Advantage of Winkler Process

As already indicated, the process has a relatively poor thermal efficiency, up to 50 per cent of the carbon in the charge being carried off in the "fly ash." That this dust may be utilised for boiler firing, with the granting of an appropriate credit, does not affect the thermal efficiency of gas production.

Finally, all processes using oxygen gasification have an added disadvantage in that any oxygen in the blast must eventually appear as carbon dioxide in the gas. Heavier compression and scrubbing costs are therefore involved in the elimination of this higher carbon dioxide content.

The supreme advantage of the Winkler process lies in the ability to utilise low-grade fuels, the gasification of which by any other method would be extremely difficult or almost impossible. For this reason a strong case may be made for the serious study of the process in this country, with particular reference to the utilisation of such low-grade fuels as washery sludges, carbonaceous shales, pit-bing shales, coke-breeze, and peat. Water-gas obtained from the Winklers may be expected to have a calorific value of about 200 to 250 B.Th.U. per cu. ft. Such a gas would prove of considerable value industrially as a fuel, while the carbon monoxide and hydrogen contents are sufficient to warrant its consideration as a basis for chemical synthesis. While the calorific value is rather low to justify extensive distribution of the gas through a gas-grid, there are good grounds for believing that methanisation may be comparatively easily effected, yielding a gas eminently suitable for transmission through a grid.

Two operating advantages are offered by the Winklers in contrast to the usual type. First, Winkler units may be made with a very large capacity. Outputs of 1¾ million cu. ft. per hour may be secured, in contrast with about 280,000 cu. ft. per hour with the largest coke water-gas generators. This factor is particularly valuable in the treatment of small-size particles of low-grade fuels. Second, the output of gas per unit of grate area is very high—32,000 to 45,000 cu. ft. per sq. ft. of hearth area, compared with about 2500 cu. ft. per sq. ft. of hearth in the coke water-gas generators.

Figures showing the performance of typical Winkler generators and the consumption of fuel, steam and oxygen are tabulated in Table 1.

TABLE I.

PERFORMANCE OF WINKLER GENERATORS PRODUCING WATER GAS BY USE OF THE STEAM/OXYGEN BLAST AND EMPLOYING "GRUDE" COKE OR DRY BROWN COAL.

	"Grude" Coke	*Dry Brown Coal*
Fuel employed :—		
Actual production of Water Gas per hour per unit (cu. ft.) ...	1,765,000 to 2,118,000	955,000
Fuel Analysis :—		
Carbon	68.0%	59.3%
Hydrogen	2.0%	4.4%
Oxygen	2.2%	15.2%
Nitrogen	—	0.7%
Volatile sulphur ...	1.3%	3.3%
Ash	26.5%	16.7%
Water	2.0%	8.7%
C.V. (B.Th.U. per lb.)	10,700	9,300
Final size grading ...	Av. 3 mm.	Av. 3 mm.
Analysis of Gas produced :—		
CO_2	20.0%	21.8%
CO	37.5%	35.3%
H_2	39.5%	38.5%
CH_4	1.5%	1.8%
N_2	0.5%	1.1%
H_2S	1.0%	1.5%
C.V. of gas (B.Th.U. per cu. ft.)	224	222
Oxygen in total blast ...	40% to 50%	40%
Fuel bed temperature ...	850° to 900° C.	—
Gas exit temperature ...	900° to 950° C.	—
Gas temperature after waste heat recovery ...	200° C.	—
Dust content of gas (lbs./1,000 c. ft.)	7.5 to 15	6.9
Supplies required (per 1,000 cu. ft. of gas produced) :—		
Fuel (lbs. per 1,000 cu. ft.)	39.8	51.7
Carbon (lbs. per 1,000 cu. ft.)	26.6	28.1
Oxygen (cu.ft. per 1,000 cu. ft.)	320 to 335	336
Steam (lbs. per 1,000 cu. ft.)	22	25.4
Steam raised (lbs. per 1,000 cu. ft.) ...	36.2	37.4
Steam decomposition ...	—	33
Carbon utilisation ...	88	86.5
Dust blown over with gas (lbs. per 1,000 cu. ft.) ...	10 to 16	9.3
Grate ash	—	2.56
Power (excluding oxygen production) (kWh per 1,000 cu. ft.)	—	1.36

(British equivalents given above have been calculated from the original German Data embodied in *BIOS Final Report No.* 333.)

Some experimental work was carried out at Leuna[1] on the oxygen gasification of hard "grude coke" in stationary bed producers of the usual type. In those circumstances the performance should approximate to the

data given in Fig. 1, a fact which proved substantially true in practice. Again, the cost of oxygen proved the most difficult economic problem, while this advantage was not outweighed by the utilisation of very low-grade fuels, as was possible in the Winklers.

Following upon the development of the Winkler generator at Leuna, experiments were begun to gasify "grude" coke or hard coke in a generator with a fixed grate, the oxygen content of the blast being maintained sufficiently high to fuse the ash produced. Six of these slagging generators were built at Leuna,[1] each with a capacity of 450,000 cu. ft. per hour of substantially nitrogen-free gas. The generators were constructed of ½ in. steel plate, the diameter at the tuyeres being 2.5 m., tapering to 3.8 m. at the widest part. Overall height of the generator is 7 m. above the tuyers, while the fuel bed is maintained at a thickness of about 4 m. above the tuyere line. The top part of the shell, above the fuel bed, was lined with refractory, a similar construction being utilised in the crucible part of the generator from the tuyere line down to the bottom. Around the actual fuel bed the generator is unlined, some being fitted with water cooling jackets and others cooled by water-sprays. Apparently the existence of the water-jacket had caused serious trouble on one occasion when a leak caused the converter to be extinguished and oxygen, entering the pipe line, caused a serious explosion.

TABLE II.

FIXED-GRATE SLAGGING PRODUCERS USING OXYGEN AND STEAM FOR GAS PRODUCTION AT LEUNA.

Type of Fuel used	*Ash Product from usual make and blow generators (50% Carbon)*	*"Grude" Coke*	*Metallurgical Coke*
Gas Analysis :—			
CO_2	9.7%	5.4%	6.8%
CO	66.5%	62.4%	61.4%
H_2	22.9%	31.2%	31.0%
CH_4	0.0%	0.0%	0.0%
N_2	0.9%	1.0%	0.8%
H_2S (gms. per cu. m.)	2.7%	13.0%	4.3%
Requirements (per 1,000 cu. ft. of producer gas made) :—			
Oxygen (cu. ft.) ...	347	276	262
Steam (lbs.) ...	13	17	21
Fuel (lbs.) ...	(not given)	50	30
Carbon burned (lbs.)	(not given)	30	26.6
Fuel Analysis :—			
Carbon	45.50%	54%	86.8%
Ash	55.40%	16.9%	9.1%
Moisture	Nil	22.0%	1.8%

With an oxygen/steam blast the temperature in the tuyure zone was about 1700° C., exit gas temperature being about 400° C. When necessary, limestone may be added as a flux, the slag formed being tapped off at intervals of 20 to 60 minutes.

At Leuna the main fuel employed was the waste product (Rohschlacke) from the ordinary "make and blow" generators. This product contained about 50 per cent. of carbon. With this material as fuel the oxygen in the blast could be maintained at 50 to 58 per cent, but with metallurgical coke the oxygen content had to be reduced to about 35 per cent. To flux the ash from metallurgical coke, 3 per cent of limestone and 20 per cent of slag from previous runs were added.

Typical operating results from the slagging producers when operating on three different fuels are shown in Table II.

While the development of the Winkler generator made possible the complete gasification of brown coal or "grude coke" by the utilisation of the oxygen/steam blast, similar treatment of low-grade non-coking bituminous coal presented rather different problems. Published work, available before the war, indicated that a number of the problems had been solved in a semi-scale Thyssen-Galocsy slagging producer at Duisburg-Hamborn. This plant, of 2 tons per day capacity, was later supplemented by a 10-ton per day plant at the ammonia synthesis plant at Pecs, Hungary.

According to the literature, the essential features of the producer were the admission of oxygen at two or more levels, in an endeavour to spread the reaction zone, and, second, the recirculation of a portion of the exit gas and its re-admission through the tuyeres. It was claimed that this re-circulation of the exit gases enabled better reduction of the carbon dioxide to be secured and prevented excessive localised over-heating by the oxygen blast.

Large Generator

The recent CIOS report[3] gives very useful data relating to a 40-ton-per-day generator built during the war at the *Krupp Treibstoffswerk Wenne Eickel*. According to the information obtained, this generator was erected because the semi-scale unit at Duisburg-Hamborn was not sufficiently large to furnish conclusive data on the results obtainable in the gasification of various fuels. It was hoped to demonstrate in the 40-ton unit that it was feasible to gasify any grade of fuel in any combination of sizes from 5 mm. to 80 mm. whether coking or non-coking and regardless of the ash-flowing temperature.

As will be evident from the drawing in Fig. 4, the 40-ton unit was shaped like an iron blast furnace, being about 35 ft. in height and 10 ft. in diameter at the bosch. Provision is made for three levels of tuyeres, five tuyeres being fitted on each level. The tuyeres at the lowest level are actually water-cooled burners in which the re-circulated producer gas is burned in the mixture of oxygen and steam. The products of combustion are then admitted to the generator, having reached a temperature suffi-

ciently high to enable the steam and carbon dioxide to react with the carbon of the charge. The percentage of the total make of gas re-circulated to the tuyeres appears to vary from 12 to 16. The tuyeres at the upper levels are not water-cooled, being utilised only for the admission of additional oxygen. This secondary oxygen is employed to provide additional heat to balance that required for the reduction of the steam and carbon dioxide and to melt the ash. Only one level of tuyeres is utilised for the admission of oxygen at any one time, the choice of level being determined by the combustion conditions obtaining.

The principal aim is to spread the zone of combustion and to reduce the localised high temperatures in an attempt to prolong the life of the refractories.

While the greater part of the interior of the generator is lined with firebrick, a band of carbon blocks 1 m. wide is inserted round the bottom of the shaft to resist the corrosive action of the slag. The slag tap-hole is located at a height of 650 mm. above the bottom of the shaft, while any metallic iron reduced from the ash is drawn off through a tap-hole at the bottom of the shaft. A further modification in the fire-brick lining is the insertion of two tiers of steel water-jackets around the shaft just above the lowest set of tuyeres. The water jackets are arranged in two tiers of 10 segments each, the two tiers being necessary to permit of the replacement of any damaged or leaking segment.

A cylindrical hollow steel shaft is fitted vertically in the upper zone of the generator to equalise gas resistance throughout the total cross sectional area of the fuel bed. Fuel charged by the bell falls into the annular space between the wall of the generator and this steel shaft. The shaft is made in two sections, each 2000 mm. long, the upper being 1200 mm. in diameter and the lower 1500 mm. in diameter. A truncated hollow cone is fitted to the top of the shaft, while the lower part is connected to the upper part of the shaft by a conical expansion piece. This arrangement is claimed to eliminate the tendency of the gases to rise up through the charge along the wall of the generator. By banking up the charge along the wall the resistance of the centre of the fuel bed is decreased to the point where it is more or less equal to, or even less than, the resistance along the wall.

Piping arrangements required are fairly complex to allow any combination of operating conditions to be met. Steam is admitted to the oxygen line at a considerable distance from the generator to ensure

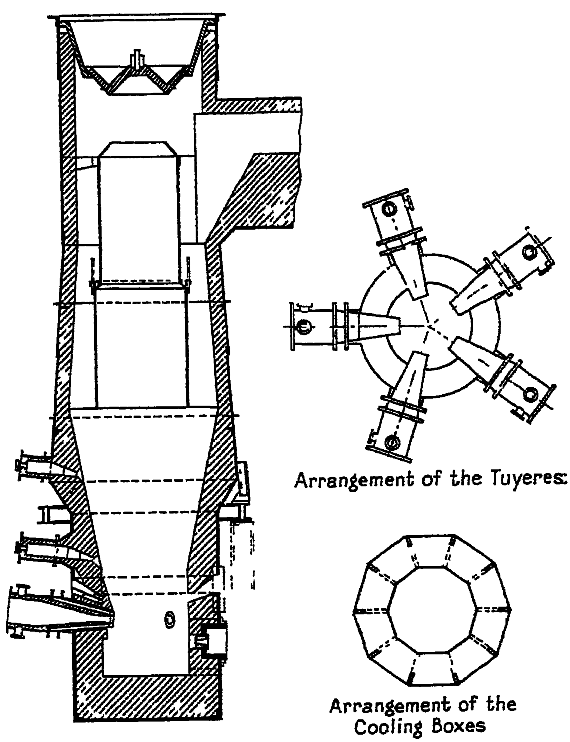

Fig. 4. Thyssen - Galocsy slagging generator at Wanne-Eickel (CIOS File No. XXIX-51).

thorough mixing, while the oxygen is passed through a water-seal to act as a barrier to the passage of gas from the generator back into the oxygen line.

Many different types of solid fuels have been tried out on the 40-ton unit, including coke, non-coking coal and waste material from the conventional generators. A test of four weeks' duration proved that no operating difficulties were experienced with coke of 40 to 60 mm. in size. A temperature of 1600° C. was required for coke with 8 to 10 per cent of ash without the addition of limestone or other fluxes. Under these conditions 40 tons of coke per day were gasified with a yield of 3½ million cu. ft. of gas with a C.V. of 270 to 290 B.Th.U. per cu. ft.

Oxygen was purchased at 2.3 pf. per cu. m. (say, 1s. 6¾d. per 1000 cu. ft.) An average oxygen consumption of 300 cu. ft. per 1000 cu. ft. of gas produced, as reported by the C.I.O.S. investigators, is approximately 50 per cent higher than the figure mentioned in previously published work.

TABLE III.

COMPARISON OF THE PERFORMANCE OF A FIXED-GRATE GENERATOR FOR WATER-GAS PRODUCTION USING "GRUDE COKE" WITH (*a*) THE USUAL "MAKE-AND BLOW" CYCLE USING AIR, AND (*b*) OXYGEN/STEAM BLAST.

	(*a*) "*Make and Blow*" *with Air*	(*b*) *Oxygen/ Steam Blast*
Analysis of Gas produced :—		
CO_2	5.0%	22.7%
CO	42.0%	34.7%
H_2	49.0%	40.3%
N_2	4.0%	2.3%
Assuming that all the gas produced is converted to hydrogen, the following are the requirements per 1,000 cu. ft. of hydrogen :—		
Hard coke (lbs.)	38.9	35.2
Oxygen (cu. ft.)	—	290.0
Steam to generator (lbs.) ...	48.4	66.0
Steam to conversion plant (lbs.)	37.7	65.7
Total steam required (lbs.) ...	86.1	131.7

(British equivalents given above have been calculated from the original German Data embodied in *CIOS File No.* XXXII—107, and *BIOS Final Report No.* 199.)

Dr. Rettenmaier, the chemist responsible for the development work, stated that cheaper oxygen could be produced by using coal screenings to generate high pressure steam for the turbo-blowers and compressors in the *Linde-Frankl* plants and utilising the exhaust low-pressure steam for gasification in the generators. In his opinion oxygen could be produced in this manner at 1 to 2 pf. per cu. m. (say, 8d. to 1s. 4d. per 1000 cu. ft.).

Table IV shows the results obtained using coke with 85 per cent fixed carbon and average particle size 40 to 60 mm., the figures being obtained in three typical operations, each of one day's duration.

It is to be noted that the figures for the percentage steam decomposition are very high, while those for coke consumption are surprisingly low, particularly as about one-sixth of the total gas make is burned at the tuyeres. While there is no apparent reason for doubting the accuracy of the figures quoted by the German operators, the coke consumption represents a very high level of efficiency. The team of investigators state[3]: "All of the available figures are presented without change. No attempt was made to check the claimed efficiencies and percentage of steam decomposition, nor have any calculations been made on the rate of gasification. The previously published data on the

TABLE IV.

THYSSEN-GALOCSY SLAGGING GAS PRODUCER AT WANNE-EICKEL

Using coke with 85 per cent. fixed carbon and 40 to 60 mm. in size, the following results were obtained in a Thyssen-Galocsy slagging producer in three typical operations each of one day :—

	Test 1	2	3
Coke gasified (85% fixed carbon, 40 to 60 mm.)	46.6 tons	39.2 tons	41.3 tons
Steam used for gasification	25.8 tons	17.8 tons	18.9 tons
Coke gasified per hour per sq. ft. of hearth area	255 lb.	215 lb.	232 lb.
Oxygen supplied :—			
Purity	81%	90%	90%
Volume in cu. ft. ...	1,132,250	868,000	903,000
Auxiliary Gas (gas produced but burned at the tuyeres) in cu. ft.	571,550	562,450	603,750
Oxygas produced (total production *less* auxiliary gas) in cu. ft.	3,689,000	2,963,275	3,124,450
Analysis of Oxygas produced :—			
CO_2	4.6%	2.1%	2.1%
O_2	0.1%	0.1%	0.1%
CO	65.3%	70.4%	71.0%
H_2	24.6%	23.1%	23.3%
CH_4	0.2%	0.2%	0.2%
N_2	5.2%	3.4%	3.3%
Lower C.V. of Oxygas (B.Th.U./cu. ft.) ...	272	286	288
Steam decomposition (per cent.)	82.1	90.1	90.1
Percentage gasification :— $\frac{\text{(Total gas C.V.)}}{\text{(Total coke C.V.)}}$	85.5	85.2	86.7
Requirements for each 1,000 cu. ft. of Oxygas produced :			
Pure Oxygen (cu. ft.)	300	290	290
Steam (in lbs.) ...	16	13	13
Coke (in lbs.) ...	27.6	29.0	29.0

(British equivalents given above have been calculated from the original German Data embodied in *CIOS File No.* XXIX—51.)

Thyssen-Galoscy process are not available for comparison with the results presented to this investigating group. It appears, however, that the gas composition is about as previously reported, but that the oxygen consumption—which is one of the major factors in the cost of production—is ap-

proximately 50 per cent higher than mentioned in any of the reviews."

[The second part of this article will appear in a subsequent issue.]

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Andersonian Chemical Society

Diamond Jubilee Celebrations

THE diamond jubilee of the Andersonian Chemical Society was celebrated in the Chemistry Department of the Royal Technical College, Glasgow, on November 22, when the large audience included members of other chemical societies, together with members of the public.

The honorary president, Professor W. M. Cumming, O.B.E., D.Sc., F.R.I.C., M.I.Chem.E., F.R.S.E., read various congratulatory letters and telegrams from other chemical societies and from various distinguished members of the Andersonian Chemical Society who were unable to be present.

Dr. D. S. Anderson, B.Sc., A.R.T.C., M.I.Chem.E., director of the Royal Technical College, referred to the excellent record of the Society throughout its 60 years of continuous existence. He pointed out that, although, as far as the College Chemistry Department was concerned, the past seven years was a period of "marking time," the future held great opportunity for teaching and research. Chemistry was "the Aladdin's Lamp of Science," and the world of the immediate future would prove to be a chemist's world rather than an engineer's world. The creation of new materials, which was the domain of the chemist, would be the major factor in the development of new industrial processes. It was to be hoped that many of the students would remain in Scotland to foster the establishment of genuinely new, and much needed industries.

The president of the Andersonian Chemical Society, Mr. J. B. Leitch, thanked Dr. Anderson for his opening remarks, and Professor Cumming called upon Professor J. W. Cook, D.Sc., Ph.D., F.R.I.C., F.R.S., Regius Professor of Chemistry at Glasgow University, to deliver the address in commemoration of the Society's jubilee.

Professor Cook expressed his appreciation of the honour conferred upon him and said that while the Andersonian Chemical Society was one of the oldest of chemical societies, it was possibly unique in having maintained a continuous existence for 60 years. He went on to give an interesting account of the history and development of the College from its foundation in 1796 under the will of John Anderson, M.A., F.R.S., Professor of Natural Philosophy in the University of Glasgow. This account was fully illustrated by an excellent series of lantern slides giving reproductions of portraits of former professors of the college and former honorary presidents of the Andersonian Chemical Society, together with views of the early college buildings. Among its professors were many distinguished in natural philosophy and chemistry, such as Thomas Garnett, M.D.; George Birkbeck, F.R.S.; Andrew Ure, F.R.S.; Carey Foster, F.R.S.; H. S. Herschel, F.R.S.; George Forbes, F.R.S.; Thomas Graham, F.R.S.; T. E. Thorpe, F.R.S.; Wm. Dittmar, F.R.S.; W. H. Perkin, F.R.S.; E. J. Mills, F.R.S.; G. G. Henderson, F.R.S.; and I. M. Heilbron, F.R.S. One of these, Professor Wm. Dittmar, F.R.S., was Professor of Chemistry when Anderson's College Science Society was brought into being in 1886 and he became its first honorary president, with Dr. Wm. Cullen as first secretary. A year later this society changed its name to The Andersonian Chemical Society. The original function of the society was set out as follows: To read papers on and discuss and debate on scientific subjects principally. Professor Cook described the state of knowledge in the various branches of chemistry at the time of founding of the Andersonian Chemical Society and the development of chemistry during the lifetime of the society. He suggested that it would be greatly to the advantage of the student members of the Society to take part in and encourage discussions and debates between themselves rather than listen to lectures by experts. In the present period of social revolution, it was desirable that powers of judgment and independent thought be encouraged by universities and technical colleges, which should seek to educate their students in the fullest sense and keep them informed on the widest

variety of topics. Professor Cook concluded by wishing the society a successful and vigorously active future in order that it might on some later date celebrate its centenary with an even greater pride.

Dr. William Cullen moved a vote of thanks to Professor Cook and recalled the days when he was first secretary of the society.

Professor Cumming emphasised the indebtedness of the society to Professor Cook, and as a gesture of goodwill he proposed that Professor Cook be elected an honorary vice-president of the society. Professor F. S. Spring, Ph.D., D.Sc., F.R.I.C., seconded this proposal and Professor Cumming terminated the proceedings by voicing the thanks of the society to the staff and students of the college for their efforts and to the industrial firms concerned for the loan of equipment for exhibition purposes.

During the afternoon a large number of visitors inspected the teaching and research laboratories in the School of Chemistry. The technical chemistry department was particularly popular and a keen interest was shown in the different types of chemical plant on view. These included a semi-technical distillation unit, film evaporator, filter press unit, drying oven, refrigeration unit, homogeniser, sugar refining plant, single tube evaporators, high-pressure autoclave, high-pressure circulatory system, gas compressor and holder, rotary vacuum filter, and a small producer unit (from the original Anderson's College). On view also were the workshop, with milling and drilling machines and heavy precision lathes, the fuels testing laboratory, a thermal diffusion unit, and a high-vacuum distillation unit. In the dyeing and colour chemistry department, much interest was aroused by an extensive collection of multi-coloured exhibits which included dyed wools, rayons, silks and cottons, while diagrammatic posters depicted the processes of manufacture of certain dyestuffs. On view also were many different forms of various plastics, while the ladies were particularly interested in samples of machine-printed fabrics, dyed hides, glass fibre cloth, coloured woollen fabrics and vegetable protein fibre cloth.

During the afternoon, tea was served. A highly successful dance on Saturday evening concluded the proceedings.

German Technical Reports

Some Recent Publications

SOME of the latest technical reports **from the Intelligence Committees** in Germany are detailed below. Copies are obtainable from H.M. Stationery Office at the prices stated.

BIOS 629. Investigation of synthetic resins used in the German surface-coating industry (12s.).

BIOS 660. *Ruetgerswerke A.G., Rauxel*: Distillation of coke-oven tar (2s.).

BIOS 724. Electronic principles as applied in Germany to the testing of materials (16s. 6d.).

BIOS 732. *Luenburger Wachswerke A.G., Luenburg*: Waxes (2s.).

BIOS 736. Chemical laboratory instrumentation (3s.).

BIOS 739. *I.G. Ludwigshafen*: Maleic anhydride by oxidation of crotonaldehyde (6d.).

BIOS 742. *I.G. Farben, Ludwigshafen*: Preparation and polymerisation of vinyl ethers and preparation of acetaldehyde from methyl vinyl ether (1s.).

BIOS 744. *I.G. Hoechst*: Manufacture of vinyl acetate polymers and derivatives (1s. 6d.).

BIOS 745. *I.G. Hoechst*: Manufacture of monomeric vinyl acetate (1s.).

BIOS 746. *I.G. Ludwigshafen*: Vinyl carbazole and vinyl pyrollidone (6d.).

BIOS 747. *Ruhrchemie, Holton*: Acetylene by the arc, also the oxosynthesis (6d.).

BIOS 763. Identification of dyestuffs in I.G. (6d.).

BIOS 772. *Kalle and Co., Wiesbaden/Biebrich*: Manufacture of diazo chemicals (2s.).

BIOS 776. *I.G. Farben, Wolfen*: Manufacture of ethylene oxide, ethylene glycols, and ethylene chloride (4d. 6d.).

BIOS 839. Report on investigation of methods of gaseous metal treatment (2s.).

BIOS 851. *I.G. Hoechst*: Chlorinated methane derivatives (1s. 6d.).

BIOS 852. *I.G. Leverkusen*: Hydrofluoric acid (1s.).

BIOS 863. *I.G. Farben Fabrik, Wolfen*: Production of liquid sulphur dioxide (2s.).

BIOS 877. *I.G. Oppau*: Oxidation of hydrocarbons to ethylene and of methane to acetylene, with conversion of acetylene to acetone (1s.).

FIAT 699. Magnesium determinations in aluminium (6d.).

Designed to cover the firm's export activities, a booklet entitled *Service to industry by Whessoe during the period of reconstruction in Britain and overseas* is the latest publication by Whessoe, Ltd., 25 Victoria Street, London, S.W.1—a title impressively supported in the interesting range of photographs and explanatory text. Copies of the booklet are obtainable from the firm.

CONVERSION TO FUEL OIL

by F. J. ERROLL, M.A., A.M.I.E.E., M.P.

FUEL oil may be used industrially for central heating and general steam-raising boilers, for furnaces, and for ovens; and a broad distinction between the two grades of oil, pool fuel oil and heavy fuel oil, is that the latter is only suitable where preheating and pumping arrangements are adequate for handling this higher viscosity liquid, which means in practice the use of larger sizes of boilers and furnaces.

During the year ended April 1, 1943, only 110,000 tons were used for industrial steam-raising out of a total of 840,000 tons used for all industrial purposes in Great Britain. The main uses were in metallurgical furnaces where a total of 420,000 tons were consumed, and in industrial furnaces, other than metallurgical, a further 35,000 tons were used. The chief remaining uses were in the glass industry 120,000 tons, bakeries 50,000 tons, vitreous enamelling 14,000 tons, and bricks and pottery 4000 tons. Consumption in that year, 1943, represented less than 1 per cent of the coal used in this country.

The New Situation

That situation has persisted since the duty of £1 a ton was imposed in 1933 as a protection for Britain's coal and gas industries. In the ensuing period the relative consumption of fuel oil has not increased at the expense of other fuels, as it had been doing; on the other hand, it has not markedly declined either. Presumably the lifting of the duty will act as a lifting of the flood-gate, or at least of the lock-gate. To estimate what power has been dammed up behind the gate—or, in other words, to assess the new situation created by the remission of the duty on imported petroleum fuel oil—a number of factors need to be taken into account. These are:

1. The comparative availability of solid and liquid fuels (a) immediately, (b) over a period of years.
2. The cost of installing the necessary plant and equipment for oil firing.
3. The comparative operating costs of fuel oil and solid fuel or gas.
4. The technical and other operating advantages of the alternative fuels.

There is no known formula applicable in all instances; the answer must be a balance of these several factors.

On the issue of supplies, industry is already fully informed of the dangers of the present and prospective coal situation. The chances are that for a few years the output of the mines may fall so far short of the demand that firms may be unable to obtain sufficient coal for all their purposes. Seen in this light, a partial conversion to fuel oil is in the nature of an insurance policy. That sufficient supplies of fuel oil, on the other hand, shall be available during the next two winters has become the personal responsibility of the Minister, who is satisfied that an increased consumption of 3,000,000 tons is feasible from the supply point of view.

On a long-term outlook there is no real likelihood of supplies drying up in the foreseeable future. On the other hand, improvements in the refining of petroleum may leave a progressively smaller residue for use as fuel oil; and in fact it should be noted that the present market for the oil is not such that it is in need of large new outlets. On balance, there is no greater danger of a long-term deficit of fuel oil than of a prolonged shortage of coal, and it is unlikely that installations made in response to the present coal crisis will be starved by fuel within the next decade.

The cost of installation varies between wide extremes, depending naturally on the character and scale of the individual instance. It has been estimated that the cost of conversion for a works using about 10,000 tons of coal a year might range from £8000 for a simple steam-raising plant of six Lancashire boilers to as much as £30,000 for a more involved installation. In determining whether the installation is justified, a powerful factor is that it may save the factory from a shut-down due to fuel shortage.

Reasons for Conversion

One large Midlands firm decided to install auxiliary steam-raising plant for seven existing Lancashire boilers, to consume between 25,000 and 45,000 gallons of fuel oil a week. By interlinking the storage plant at their foundry and forging factory they were able to effect the installation for less than £5000. To justify installation at this cost there must either be marked technical advantages or a material possibility of sustaining increased productive activity. On the latter point, one firm in the chemical industry has determined to make the conversion partly because the shortage of coal has reduced the export value of a major product by £2,500,000 per annum. This firm is technically capable of burning 1,100,000 tons of fuel oil a year in place of 1,800,000 tons of coal if the necessary plant is installed.

Operating costs also vary according to the use. In the non-ferrous industries, for ex-

ample, the general experience in firing furnaces has been that fuel oil—even when carrying the duty—worked out at anything up to 25 per cent cheaper than solid fuel or gas, though this figure is based to some extent on such operating economies as the elimination of scrap. The removal of the duty has encouraged still further conversions in this industry, which on all grounds is one of the best suited to use fuel oil.

Comparison of Costs

For steam-raising purposes, probably the most important in the case of the chemical and allied industries, fuel oil has not hitherto shown a cost advantage over coal. With coal at 46s. a ton, and oil at 152s., the weekly operating costs of six shell boilers totalled £788 for mechanically-fired coal plant, £840 for hand-fired coal plant, and £1162 for oil plant. The repeal of the duty brings the oil figure down to £1028, while coal prices to-day are never below 50s., and more often reach 60s. At the latter figure mechanical firing would cost £958 a week, and hand firing £1020, so that on basic costs there is nothing much to choose. When, however, there is also taken into consideration the cost of coal handling and the lower operating costs for fuel oil, the latter is seen to have a clear-cut advantage on a cost basis alone. Even in cases where cheap coal inclines the balance in favour of the solid fuel, there are still boiler operators who prefer oil, maintaining that the extra cost is balanced by the ease of handling and stoking.

This leads to the final set of factors to be taken into account—technical and operating advantages. These may be summarised as ease and accuracy, convenience, and reliability. Fuel oil has a uniformity of composition which in these days of slatey and otherwise undependable coal is a far from negligible quality. The oil permits easy adjustment of furnace atmosphere and the application of thermostatic control. The highly radiative nature of the flame may be an advantage or a disadvantage, according to whether high, low or moderate temperatures are required.

Compared with coal, fuel oil is less trouble to store and handle: it occupies less space and demands less handling equipment. For another thing, it can often be used in confined spaces where coal handling plant cannot effectively penetrate. Delivery is by tank wagon and unloading is by pipe rather than by hand or complicated machinery.

Other sources of operating economy are: firstly, the thermal efficiency in use is increased by valve control and ease of adjustments of the atmosphere; secondly, the output of the plant can be increased because the plant is more rapidly heated from cold to working temperature, and because goods are more quickly heated by the high radiating power; and thirdly, lower fuel consumption is permitted, since when the furnace is not needed the fuel supply can be completely shut off.

It is true that in many of these respects fuel oil has no advantage over town gas. Indeed, under conditions in which ease of operation, use in a confined space, and convenience of adjustment are important, gas is the natural competitor. In general, however, gas is considerably more expensive.

In the light of these various factors must any proposal to convert to fuel oil be considered? If on balance it is accepted as wise in all the circumstances, the following brief account of the necessary installations may serve as an introduction to the subject. At the storage end, difficulties of supply are being experienced owing to the universal shortage of steel sheet and its heavy demands for other purposes. When steel tanks are available they are better welded than riveted; they are normally of a sufficient capacity to take 100 tons or more, or are of a subsidiary typo capable of taking up to 40 tons. One method of meeting the supply situation is to use concrete tanks, which are likely to come increasingly into use. It is important, however, that there should be some facing material impervious to the oil, which will seek out possible leaks very quickly.

Storage Precautions

Storage plant may be sited almost anywhere, above, on, or below ground, in basement or on the floor of most factories. Around the tank, however, there should be installed a reasonably oil-tight catch-pit capable of holding a minimum of 80 per cent of the contents; this will serve as an insurance against valve fracturing. It is also advisable to fit a vent pipe to enable rapid filling without danger of undue pressure. In open situations frost should be guarded against by using cast steel for the main valves, by lagging, and by using wrought iron for bend joints and similar fittings.

Pumping systems are manufactured by a number of specialist firms, and a selection can be made from the direct-acting steam pressure pump, electric-drive pressure pumps and two-thrown pumps, and direct-acting transfer and forced lubrication pumps.

In using fuel oil two stages of pre-heating are necessary, the first at the main storage tank to raise the oil to a temperature sufficient to secure the flow to the pump, the second at the burners to permit atomisation. Oil is characterised by viscosity, which is the degree of its fluidity, and this varies according to the temperature. Setting point is the temperature at which the oil changes from fluid to solid state. Flash point is the temperature at which, on being slowly heated, it begins to evolve a vapour

which, with air, forms an explosive mixture. Firing point, finally, is the temperature at which an oil will yield a vapour which when ignited burns continuously.

The amount of pre-heating required varies according to the nature of particular installations, and among the factors to be considered are the grade of oil, arrangements of tanks and pipes, and the type of burner in use. The atomising burners are of three main types: pressure-jet burners, used mainly for steam boilers; steam jets, also used mostly for steam-raising; and air-jet burners for industrial furnaces. These also tend to be in short supply as the result of the sudden new demand, but the position may be eased by supplies from the U.S.A.

If a changeover is effected in stages, where more than one boiler is in use, the risk of a total shut-down is averted in the early stages, and staff can be accustomed slowly to the new routine. But expert advice, preferably by the boiler makers themselves, should be obtained before converting existing boiler plants. Advice should also be taken of the Regional Officers of the Petroleum Board who are acting as advisers to the Ministry of Fuel and Power in this connection. They will be able to advise on the local position with regard to the availability of oil supplies, and also on the new zonal pricing system, which ranges from 7¾d. to 10¼d. for pool fuel oil, and from 7¼d. to 9¾d. for heavy fuel oil, per gallon, as between areas around the main ports and inland areas.

When the Minister of Fuel was asked for an assurance that firms making a partial conversion will not have their allocations of other fuels cut by a corresponding amount, the reply was not entirely satisfactory. In effect, consumers who convert partially to oil have an assurance of full supplies of oil for the converted plant, together with their fair share of the available supplies of coal for their remaining production. Conversion cannot therefore be regarded as a gross gain in the satisfaction of total fuel requirements.

No assurance has been given as to how long the repeal of the duty will remain effective, although there are strong hints from the Ministry that no re-imposition is at all likely while fuel continues to be anything like the problem it is to-day. In the short run, therefore, fuel oil may be a valuable stop-gap; in the long run it has still to justify itself.

Fuel Efficiency

Summing Up of Recent Conference

THE November issue of *Fuel Efficiency News*, published by the Ministry of Fuel, contains reports by the chairmen of the various sections at the recent conference on "Fuel and the Future." Below are extracts from the report of Dr. E. V. Evans, chairman of the Carbonisation and Chemical Industries Section:

The industries for which I speak, the gas industry, the coke-oven industry, and the chemical industry, deal with about 50,000,000 tons of coal annually. In each of these industries voluntary organisations for conserving fuel have been established during the war years, and I am pleased to say there is a friendly and stimulating rivalry in fuel efficiency between the separate units of each industry.

In the carbonising industries the problem has been to make the best use of existing plant and it may be said that, despite the difficulties of the war period and the shortage of labour, the deterioration in the quality of coal and the difficulties associated with ageing plant, it has been possible to maintain high thermal efficiency. A fine piece of team work has been effected and, what is of importance to the Minister, this work will continue. The same, indeed, may be said of the chemical industry.

A fair proportion of the plant in existence was designed at a time when fuel economy was a less important issue than it is to-day. Coal was cheaper and considerations of capital cost limited the full employment of fuel saving devices. It is obvious that new plant will take a much greater account of these principles of design which lead to the utmost thermal economy. Each plant and each process presents a different problem in the balance of heat and power requirements and the solution of these problems of applied thermo-dynamics will be a primary feature in future plant design.

Many interesting references were made to indirect fuel savings. It was pointed out that in the case of gaseous firing a high degree of efficiency is possible because that fuel is capable of accurate control and furnaces may be designed to fit the work schedule. Again, the production of goods with a smaller proportion of rejects represents a real and substantial saving. The chemical industries have pointed out how the prevention or reduction of corrosion can produce a large, though not always immediately obvious, fuel saving.

All three industries represented in this section are facing a large programme of work in maintaining the efficiency of existing plant and of designing, erecting, and operating new plant.

Chemical Exports

Highest in Value Since the War

THE value of U.K. exports in October was £90.9 million. This is only £1 million less than the peak month of July, which had the same number of working days. The increase compared with September is £20.1 million, but this comparison is less satisfactory owing to the reduction caused by holidays in that month.

Exports of chemicals, drugs, dyes, and colours—which are grouped together in the Board of Trade returns—reached the highest value since the end of the war, the total figure being £6,545,179. This is an increase of £1,969,711 compared with September; an increase of £1,376,605 compared with October last year; and £4,688,530 compared with the monthly average for 1938. Chemical manufactures and products (other than drugs and dyestuffs) accounted for £3,401,602 of the total; drugs, medicines, and medicinal preparations for £1,663,348; and dyes and dyestuffs, and dyeing and tanning extracts, for £758,918. British India easily maintained her position as the leading buyer, her purchases reaching the record total of £1,292,963; Australia came second again, with a total of £395,844; and Germany, surprisingly, third with £247,083.

Imports of chemicals, drugs, dyes and colours were valued at £1,499,689, which is an increase of £518,016 compared with September; an increase of £588,374 compared with October last year; and £365,298 compared with the monthly average for 1938. The U.S.A. was the largest supplier, with goods valued at £368,933; the Argentine Republic was second (£246,466); and Spain third (£137,449).

Potassium Metal

Production by Thermic Reduction

THE FIAT Report No. 695, which is concerned with the manufacture of metallic potassium, is of importance to the British chemical industry as the German thermal reduction method had completely replaced the more usual electrolytic process in that country.

The original German process consisted of heating the mixture of potassium fluoride and powdered calcium carbide to about 1000-1100°C. in a retort. The metallic potassium vapour condensed and was stored under a petroleum oil. The basic reaction for this process is:

$$2KF + CaC_2 \rightarrow 2K + CaF_2 + 2C$$

and the yield is about 80 per cent using good quality raw materials.

Dr. Kolbe of the I.G. at Hochst further improved this method by replacing calcium carbide by elemental silicon according to the following reaction:

$$4CaO + Si + 4KF \rightarrow 4K + 2CaF_2 + 2\ CaO.SiO_2$$

The advantages of the second process over the first are obvious as far less silicon is required for the reduction of the potassium fluoride than calcium carbide, while the residues are more friable using the second reaction. It must be noted, however, that the calcium oxide must be completely dry or an explosion is liable to develop. One disadvantage of using silicon as a reducing agent is that while the initial reaction proceeds at a lower temperature the final temperature must be higher to ensure the completion of the reaction.

Full working details are given in the FIAT report of the German work to date on this subject and valuable translations are included of relevant German patents.

LINSEED OIL SUBSTITUTES

In view of the present shortage of linseed oil, it is satisfactory to note the progress made in the application of petroleum aromatic extracts to paint formulation, by which, it is claimed, it is possible to replace effectively up to 20 per cent linseed oil in all types of paint. A short booklet on the subject has just been issued by Petromar, Ltd., one of the associated companies of Manchester Oil Refinery, Ltd., Adelaide House, London Bridge, London, E.C.4, from whom copies are obtainable. As stated in THE CHEMICAL AGE on November 16 (*see* p. 604), the Paint Marketing Council has issued a statement pointing out that British paint manufacturers are in danger of losing their overseas markets unless the Government immediately increases supplies of raw materials.

NON-SILICA GLASS

The increasingly important part that new types of non-silica glass will play in optics, photography, enamels, etc., is commented upon in the October issue of *Ceramic Forum*. The new types of glass, which are made with the use of phosphates, borates or fluorides, resemble silicate types of glass in general principles of chemical construction, but differ from them and from one another in important chemical and physical properties. Non-silica glass has already proved its value in the photographic field. For general use in optical instruments, it is likely that glass intermediate between the older silica glass and the new non-silica glass will be especially valuable.

Alkali and Alkaline Earth Hydrides

A Survey of Their Manufacture and Uses

THE descaling of metals in an alkaline pickling bath, which does not require the use of electrical current, has recently opened a potential market for large quantities of alkali metal hydride. Developed in the United States during the war by the Electrochemicals Research Section of E I. du Pont de Nemours, the process has proved especially advantageous in descaling operations at wire works, being suitable for such metals as nickel and copper as well as steel. For alloy steels it shows promise of displacing to some extent the usual process of metal pickling by acid, especially in the case of stainless steels, but is also suitable for treatment of ordinary carbon steels. One advantage is that a much shorter time of immersion in the tank is needed, and therefore the possibility of detrimentally pitting the metal by careless dipping is largely avoided. There is also a notable saving of metal normally lost by solution in the acid, which for steel may amount to between 2 and 3 per cent.

The metal is first dipped into a bath of fused caustic soda containing 2 to 5 per cent of sodium hydride. Here, as a primary step, the scale is reduced. It is then, in effect but not in fact, blasted from the underlying metal by the violent generation of steam which takes place when the metal is subsequently quenched in water. As a final treatment, almost instantaneous dipping in an acid bath brightens the surface of the metal.

Reaction with Hydrogen

This practical application of a stable solution of sodium hydride in fused caustic soda for reducing metallic oxides to the metal revives interest in the hydrides of the alkali metals, also those of the alkaline earth metals, which have long remained solicitous of greater attention. These products are white crystalline solids, "salt-like" in character; which by electrolytic investigations have shown that their hydrogen behaves as the negative element, and under appropriate conditions may be used for reducing certain metallic oxides to the metal. The alkaline earth metals readily combine with hydrogen on heating, but the absorption of hydrogen by the alkali metals is exceptionally slow, and cannot be brought to completion unless the hydride is removed almost as quickly as it is formed, or, alternatively, the hydrogen is allowed to react with the metal in finely divided or vaporised form. Nevertheless, by the aid of an electrochemical process employing sufficiently high pressure for the hydrogen, alkali hydrides can be obtained in commercial quantities and at a price which permits of them being used industrially. The formation of alkaline earth hydrides, also commercially possible, proceeds with greater facility at lower pressures.

Lithium reacts vigorously with hydrogen at 600-700° C., forming a vitreous solid which melts at 680° C. Lewis (*J. Amer. Chem. Soc.*, 1916, *38*, 774) showed that this product was capable of conducting electric current, which is now true of certain other hydrides in the fused state only. The remaining alkali hydrides are prepared in a manner similar to that of lithium. Sodium hydride is formed when metallic sodium is heated in a current of hydrogen at 400° C., the reaction being promoted and to some extent controlled by the presence of a small amount of calcium or its hydride. A slightly lower temperature is needed in the case of the corresponding potassium compound. These alkali hydrides readily react with water to form the hydroxide and liberate hydrogen. This reaction, assisted by the oxidising action of the atmospheric air, may cause ignition of the hydride when exposed to dampness. Alkali hydrides are also very strong reducing agents, deposition of carbon taking place when heated in a stream of carbon dioxide. They also exhibit the property of absorbing sulphur dioxide, with formation of the hydrosulphite of the metal.

Properties of Hydrides

When heated in an atmosphere of hydrogen the alkali hydrides sublime, giving a white mass which rather resembles wadding, but which on closer examination proves to be a mass of needle-like crystals. They all conduct electricity when in the fused state, but they do not stand excessive heating, which causes them to dissociate or partially decompose into the metal and hydrogen, the latter partly in the atomic state. Apart from this they exhibit some corrosive action upon apparatus at high temperature, unless in solution in a suitable medium, such as the fused hydroxide; the corrosive action of lithium hydride is very pronounced and a subliming film of this hydride will invariably destroy the structure of any glass surface upon which it condenses. Dissociation temperatures lie very close together, excepting for lithium and the alkaline earth metals, which really show no sharp dissociation point because the temperature of decomposition rises with the quantity of hydrogen evolved and the remaining hydride then forms a solid solution with the liberated metal.

Sodium hydride, as commercially produced, is a free-flowing powder, varying from white

to grey in colour; it decomposes reversibly above 150° C., but much more rapidly at temperatures above 400° C., yielding metallic sodium and hydrogen. Moissan (*Compt. rend.*, 1902, 134/71) prepared it by heating sodium in hydrogen at 360° C. Ger. Pat. 490,077 (Deutsche Gold- u. Silber-Scheideanstlat v. Roessler, 1927) describes a process in which sodium in a finely divided state is treated with hydrogen at raised temperature, preferably in presence of a diluent which may be either an alkali chloride or carbonate, or sodium hydride previously made in small amount, the equipment being a heated rotary tube. U.S. Pat. 1,796,265 (Freudenberg and Kloepfer, assigned to Deutsche Gold- u. Silber- Sch. v. Roessler, 1931) specifies a temperature of 180-300° C.

Villard (*Compt. rend.*, 1931, 193/681) found that caustic soda and manganese could be heated in a current of hydrogen at 600° C. to produce metallic sodium, and at the same time sodium hydride was volatilised to form a deposit in a cooler part of the tube; the reaction proceeded rapidly at 700° C.

U.S. Pat. 1,958,012 (Muckenfuss, assigned to E. I. du Pont de Nemours, 1934) describes a process of manufacture in which the finely divided alkali metal is heated in an inert organic liquid distributing agent such as tetralin or "Nujol" oil for several hours in the presence of hydrogen, preferably at a temperature of about 250° C. and under a pressure of 500 lb. per sq. inch; it is said that alkali hydrides of high purity are obtained. Brit. Pat. 405,017 (Roessler and Hasslacher Chemical Co., 1934) refers to the action of hydrogen upon molten alkali metal which is distributed in finely divided state in an inert liquid hydrocarbon oil such as tetralin, commercial paraffin oil, or commercial lubricating oil, preferably at 230-400° C. and under increased pressure.

By a distinctly different process, Russ. Pat. 43,634 (Palkin, 1935) treats molten sodamide with hydrogen at a temperature not exceeding 200° C., subsequently extracting the sodium hydride from unchanged sodamide by the aid of liquid ammonia.

Few War Patents

As regards the period of the war, only one process for the manufacture of alkali metal hydrides appears in the patent literature. U.S. Pat. 2,313,028 (Siegmann, vested in Alien Property Custodian, 1942) vaporises metallic sodium in an electric arc which is struck between fused alkali metal electrodes in the presence of hydrogen maintained at a temperature of about 300° C. This process also appears as the subject matter of Ger. Pat. 730,329 (Siegmann, to Deutsche Gold- u. Silber- Sch. v. Roessler, 1942).

For the synthesis of organic compounds, sodium hydride has certain advantages as a Claisen condensation agent, either for ester and ester (e.g., ethyl acetoacetate, diethyl ethyl malonate, etc.), ketone and ester, or certain aldehydes and ester. It does not reduce unsaturation in the reacting material; secondly, it increases the speed of the reaction; and further, it actually drives the reaction to completion without the need for a tedious azeotropic distillation. According to E. I. du Pont de Nemours, it can be used in place of alkoxides to prepare any ester of acetoacetic acid and higher homologues of the common acetoacetic ester with up to 18 carbon atoms in the acid ester structure. Moreover, since the hydride does not reduce carbonyl compounds, these Claisen condensations can be carried out at higher temperatures, within the range 100-130° C., thus avoiding reduction reactions which otherwise would predominate at such temperatures if metallic sodium was used.

Use as Catalysts

Sodium hydride forms monosodium derivatives with such compounds as malonic acid and acetoacetic esters. In use for the production of alcohol-free derivatives of the unsaturated alcohols and hydrocarbons of the acetylene series, there is no simultaneous partial reduction of unsaturation. Ger. Pat. 709,227 (Hamsley, assigned to E. I. du Pont de Nemours, 1941) concerns condensation promoters in organic syntheses. Hydrides of either alkali or alkaline earth metals can be used as a catalyst, linking saturated carboxylic esters with like products, with aliphatic, aromatic, or hydroaromatic ketones, or with aromatic aldehydes, all these reactions being essentially Claisen condensations. Either the ester or the ketone has an aliphatic carbon atom with at least one hydrogen atom adjacent to the carbonyl group.

There is also another use for sodium hydride, which is rather notable. It can be used as a catalyst for the partial hydrogenation of polynuclear aromatic hydrocarbons, such as naphthalene, anthracene, fluorene, etc., even when these hydrocarbons are contaminated with sulphur. The hydrogenation of naphthalene to tetralin, using sodium hydride catalysts, has been studied by Hugel and Friess (*Bull. Soc. Chim.*, 1931, 49/1042); in these hydrogenations where sodium forms an intermediate compound with the organic structure, the lower limit of hydrogen pressure at which the reaction proceeds is stated to be about 15 kg. per sq. cm. (say, 200-220 lb. per sq. in.), and the optimum temperature is 270-320° C. Hugel and Gidaly (*Bull. Soc. Chim.*, 1932, 51/639) point out that the activity of sodium hydride in catalysing the hydrogenation of organic compounds is restricted to those parts of the molecule with which

sodium itself is capable of combining. Styrene is converted to diphenyl ethane; naphthalene to tetrahydronaphthalene; benzal fluorene to fluorene plus methyl fluorene; anisal fluorene to methyl fluorene; diphenyl butadiene to diphenyl butane.

U.S. Pat. 1,838,234 (Schirmacher and van Zutphen, assigned to I. G. Farbenindustrie, 1931) specifies the use of sodium hydride in promoting polymerisation of hydrocarbons of the butadiene series. In another direction it may conveniently be used for the linking of active methylene compounds with acrylonitrile.

Calcium Hydride

Calcium hydride is produced by the action of hydrogen on fused calcium metal, alternatively calcium chloride, at 550°C. and upwards, also by heating calcium in hydrogen at 150-300°C.; when calcium chloride is used, gaseous hydrogen chloride is a by-product of the reaction. Unlike the corresponding lithium compound, calcium hydride does not readily conduct electricity; it is stable up to 600°C., depending on circumstances, but loses its hydrogen at higher temperature. Under the name "hydrolith," it has been employed as a convenient source of relatively pure hydrogen; 1 kg. of the impure hydride, when treated with water, gives 1 cu. m. of gas. Like the hydrides of the alkali metals, those of the alkaline earths are also strong reducing agents. Methane of considerable purity is obtained by passing a stream of carbon monoxide or carbon dioxide over hot calcium hydride.

In the manufacture of calcium hydride according to U.S. Pat. 2,082,134 (Alexander, 1937), lime and powdered magnesium metal are placed in close association in a container which is filled with hydrogen, the temperature being then raised to above the melting point of the magnesium. The supply of hydrogen is maintained until all the magnesium is converted to oxide, with formation of the equivalent amount of calcium hydride. Fr. Pat. 819,533 (Ventures, Ltd., 1937) speaks of heating a mixture of lime and metallic magnesium in presence of hydrogen to a temperature above the melting point of the magnesium, a supply of hydrogen being maintained until the magnesium is wholly converted to oxide and calcium hydride is formed. In Brit. Pat. 485,163 (Ventures Ltd., 1938) it is stated that the temperature is maintained below 1100°C.

In organic synthesis, calcium hydride may be usefully employed in promoting the aldol condensations; apart from acetone, methyl ketones generally react, but not other ketones such as diethyl ketone (*Chem. Soc., Ann. Rep.*, 1925/73). In this way acetone can be converted to diacetone alcohol. Subsequently refluxed with iodine, diacetone alcohol is dehydrated to give mesityl oxide, which provides a starting point for methyl isobutyl ketone and other products, also finding use as a solvent for vinyl resins and ethyl cellulose, and in making lacquers and enamels. It would be more widely employed as a solvent and as a paint stripping agent, but for its odour suggestive of a mixture of mice and pappermint.

Calcium hydride has recently found useful application for the reduction of oxides of metals of high melting point. Investigations are reported in *J. Applied Chem.* (U.S.S.R.), 1940, 13/1770. The experiments were made with titanium dioxide, vanadium trioxide, columbium pentoxide, and tantalum pentoxide, using an electric furnace and hydrogen at atmospheric pressure. In the first three cases, employing 50 per cent excess of calmium hydride (80-90 per cent purity) and a duration of heating from 45 to 60 minutes, the most favourable temperatures were 950-1075°C., 1025-1175°C., and 950-1075°C. respectively. For tantalum pentoxide, the calcium hydride was made by heating a mixture of lime and magnesium to incandescence in hydrogen; here reduction was effected by heating for 60 minutes at a temperature of 1025-1100° C. Hydrogenated metals were produced under the most favourable conditions, the amount of hydrogen combined with the metal in the case of titanium being about 3 per cent; for vanadium, 1.2 to 2 per cent; columbium, 1 to 1.4 per cent; and tantalum, 0.5 to 1.2 per cent. The products were fine crystalline powders, of which the major portion exhibited a grain size up to 0.001 mm.

Hydrides and Water

Regarding the reaction between calcium hydride and water, Flood (*Kgl. Norske Videnskab. Selskabs Forh.*, 1935, 7/66) found that an excess of hydride and temperatures above 350° C. causes the reaction to proceed in the direction $CaH_2+H_2O \rightarrow CaO+2H_2$, whereas thermodynamic calculations indicate a metastable condition at ordinary temperature which follows the direction $CaH_2+2H_2O \rightarrow Ca(OH)_2+2H_2$. The action of calcium hydride upon media containing heavy water has been studied by Hughes, Ingold, and Wilson (*J. Chem. Soc.*, 1934/493). When part of the hydrogen is removed from calcium hydride, a single phase of solid is formed which is poorer in hydrogen. As decomposition proceeds, this phase is resolved into one product which contains more hydrogen and in composition closely approaches CaH_2, and another product containing less hydrogen which is nevertheless retained more firmly than in the case of CaH_2. With some degree of certainty it is, therefore, now generally recognised that the hydrides exist in two forms, especially those of the alkaline earth metals.

Palestine Chemical Notes

Reorganisation Needed after the Boom Period

(From Our Own Correspondent)

IN common with Palestine's other industries, the chemical industry is at the moment in the process of readjusting itself to post-war conditions. The boom period has passed, and reorganisation is necessary. Added to difficulties of importing the necessary raw materials and the high wage levels, the present boycott of Palestinian products by the States of the Arab League is also having its effects on the industry

The great demands of the Allied Forces during the war, coupled with the needs of the civilian populations in the Middle East countries as a result of the complete stoppage of foreign imports, resulted in the Palestine chemical industry finding its feet. Palestine manufactures a wide range of inorganic chemicals, fertilisers, varnishes, paints, pigments, glues, gelatine, as well as a number of organic chemicals, pharmaceuticals, photo-chemicals, edible oils, soaps, and tanning extracts, and local industries have taken advantage of the wide range of chemicals so easily available. At one time the Palestine chemical industry employed about 5000 workers.

Supply of Raw Materials

Local manufacturers have to study carefully from the business point of view the supply of raw materials in Palestine, where kaolin and other clays, iodine, manganese ores, gypsum, phosphates, and other materials are available. From vegetable and animal sources a number of raw materials are obtainable, some of which have been successfully used in local factories. Among these are carob beans, cane sugar, dates, citrus, medicinal plants, herbs, bones, hide, and wool.

The supply of pyrites from Cyprus may become an important factor in the Palestine industry. The Mediterranean island is also known to have magnesite, chalk, gypsum, and chromites in considerable quantities. The prohibition by neighbouring Arab countries of the export goods to Palestine affects various raw materials. Egypt, for instance, will not allow the export of bones for the Palestine glue industry. It is generally acknowledged that prices of Palestine manufactured chemicals are high and the first British peace-time offers created the impression that local competition would be difficult if not impossible. In the course of time, however, it was found that many British products could be delivered in only limited quantities.

The Palestine industry is aware that there is a great shortage of chemicals on the Continent and it is felt that the country might be able to assist in meeting this demand, provided the Palestinian prices and qualities are satisfactory. But the readjustment of prices is not an easy task. Wages are still at a high level, owing to the great cost of living, so that the proportion of labour costs amounts to 35 per cent of the total cost of production. This includes workmen's compensation, health insurance, paid leave and gratuities to workers. In addition, a considerable amount has to be spent on the modernisation of the present equipment, but in this respect the situation appears to be improving.

There is some speculation as to the possibilities of the Palestine chemical industry supplying part of the former German exports to the Middle East. Such a development would not interfere with British exports, but here again the political situation is proving an obstructive factor. As a result of the Arab boycott, the chemical industry is compelled to concentrate more and more on the local market, but since this is relatively small—Palestine's total Arab-Jewish population is under two million—efforts have to be made to find other markets. Contacts have already been established with North and East Africa, Greece, Turkey, and some European countries. Various transactions are at present being negotiated.

Plans For Future

Generally, although the end of profitable war contracts almost coincided with the Arab boycott, causing a most difficult transition period, most of the Palestine chemical manufacturers have been able to overcome the temporary difficulties, and are planning to continue production on the broadest possible lines.

To extend the scope of activities of the Palestine chemical industries, a new organisation, to be known as the General Society for Chemical Production in Palestine, Ltd., has been founded with a registered capital of £P100,000.

The new organisation is to erect a factory in Emek Zebulun on about 20 acres of land, and will produce sulphuric acid, phosphorus fertilisers, various kinds of aluminium products, copper sulphate, and magnesium sulphate. It is expected that the output of sulphuric acid will reach close on 15,000 tons per annum, of which two-thirds will be used in the manufacture of artificial fertilisers.

Czech National Enterprises

Synthetic Fuel from Stalin Works

REPORTS of recent developments in the Czechoslovak chemical industry indicate that ten national enterprises have been formed out of about 80 establishments which were formerly independent concerns. Six of the new enterprises have been set up in the two western provinces of Bohemia and Moravia, and four others in Slovakia. The industry employs at present about 40,000 persons and the annual value of its products aggregates about 8 milliard Czech crowns. It has been possible to increase output from about 30 per cent in 1945, to 70 to 80 per cent of capacity. At the same time a reserve of raw materials sufficient for several months, with the exception of common salt and petroleum residues, has been accumulated.

The nationalised chemical industry is said to be working at a profit and the financial results of the current year make allowances not merely for the normal depreciation of plant, but also for the assignment of considerable sums for the use of the works councils to cover social needs of the staff. The surplus finds its way into the Treasury.

As far as exports of chemical products are concerned, those in charge of the industry's affairs aim to send sufficient chemicals abroad to be able to pay for foreign raw materials. During the first half of the current year, exports of the nationalised chemical industry totalled about 150,000,000 Czech crowns. However, reference must be made to the fact that a large proportion of the output is indirectly exported, *i.e.*, after having been used by the glass, machinery, and foundry industries. Czechoslovakia's main customers have been Switzerland, Yugoslavia, Sweden, Holland, Denmark, and Austria.

Oil from Lignite

Details have been made known about the production of synthetic oil from lignite at the Stalin Works—formerly known as Hermann Göring Werke. This plant, near the town of Brüx, in North-West Bohemia, was built by the Germans, during the occupation of Czechoslovakia, at an estimated cost of 7.5 milliard Czech crowns. The intake of lignite amounted to 10,000,000 tons a year and during the occupation about 42,000 persons from all parts of Europe were employed in this giant plant, which had an important function in Germany's oil economy. Small wonder, then, that it formed an important target for the Allied air forces, which dropped nearly 14,000 bombs and more than 200 parachute mines on it, causing considerable damage.

At the end of the war, the works were considered as war booty by the Russian Government, which, however, decided to transfer it to the Czechoslovak authorities without compensation. The latter put in hand the necessary reconstruction work and plans have been made for a reorganisation of the whole plant. New dwellings for the staff and social amenities are being provided by the Czechoslovak Government.

Wide Range of Products

The Stalin Works are now producing a wide range of products, including, for instance, motor fuel, aircraft fuel, paraffin oil for tractors, and other machinery, Diesel oil, gas for use in vehicles equipped with generators, and gas for domestic and lighting purposes. Among the more specialised products are ligroin, petroleum, ether, solvents, and lubricants, while the gaseous products include propane, butane, ethane, methane, hydrogen, oxygen, and nitrogen. Basic products for the organic chemical industry, materials for use in the textile industry, softeners for the paint and rubber industry, and other products also form part of the works' manufacturing programme.

There can be no doubt that the Stalin Works occupy an important position in Czechoslovakia's national economy, and their importance will be further enhanced by the Government's ambitious fuel production programme under the new Two-Year Plan. Under this plan, the lignite deposits, which form the raw material for the Stalin Works, are to be exploited to the extent of about 23,000,000 tons. Of this, 20-25 per cent will be waste and coal dust, which are to be utilised for the manufacture of synthetic fuels and basic chemical products.

No figures have been made available as yet as to the price of the synthetic fuel, but recent increases in the price of lignite have been reflected in the price of the various products manufactured in the works. The prices are, on the whole, higher than those ruling in the world market, but it is hoped that improved production methods and the general reorganisation of the manufacturing programme will bring the price of the finished products more into line with world prices. However, it appears that in view of the centralised planned economy of the new Czechoslovak Republic, the question of prices will hardly be a decisive one. Moreover, supplies of oil from UNRRA will stop at the end of this year, and because the country has no large resources of foreign exchange to pay for the import of oil from abroad, the manufacture of synthetic fuels will receive a powerful impetus.

A CHEMIST'S BOOKSHELF

The Story of Plastics. By H. R. Fleck, M.Sc., F.R.I.C. London: The Burke Publishing Co., Ltd. Pp. 96. 7s. 6d. net.

This book, which is the first in a "Commodity Series," is not a technical treatise for the scientist, but a fascinating account for the man in the street of the growth of a great modern industry. It is written in a clear, understandable manner, and the many charts, diagrams, and illustrations, which form a main feature of the book, are well selected, thus giving a vivid pictorial survey of the manufacture and wide use of plastics. The first part of the book deals with the birth and constitution of the industry, and the next gives basic facts of the science of plastics. The author also discusses the chemistry of plastics and the moulding as well as the application and wide uses of plastic materials. He examines the opportunities that exist for administrative and technical knowledge, as well as the special qualifications required for the many executive positions. The author, who, during the war, was technical adviser on non-metallic materials and plastics to the Ministry of Aircraft Production, presents a book for everyone who would like to know the truth about these magic materials of our modern world.

Vat Dyestuffs and Vat Dyeing. By M. R. Fox. London: Chapman & Hall, Ltd. Pp. 319. Price 24s.

Mr. Fox has brought together a good deal of useful information about vat dyestuffs and their application, and the resulting book is one which will prove to be a very handy reference volume for all those whose work is connected with these products and their application and testing in industry. The specialist may not find that it deals with his own particular section in a manner sufficiently deep to satisfy him; on the other hand, those whose work is confined to the application of these dyestuffs will obtain a good general account of the chemical constitution and properties of the dyestuffs they are handling, while those whose interests are solely on the manufacturing side will find much useful information in the chapters dealing with the application of these colours in industry.

The volume leaves something to be desired when considered as a text-book, as the scientific aspects are rather sketchily dealt with. The section dealing with light tendering might well have been expanded considerably, and more could have been said of the effect of the physical properties of the dyestuffs in relation to yield of colour and shade when applied in various ways. Mention is made of the use of various auxiliary agents as levellers and dispersing agents in dyeing, but nothing is said of the selective action of many of these products and no indication is given of the precipitation of the leuco derivatives of certain vat dyestuffs when used along with specific auxiliary agents. A standard method of expressing weights and measures should have been maintained throughout. Many recipes given are expressed in English standards, while others are expressed as parts per thousand with no indication as to whether parts by "weight" or by "volume" are meant, and finally some amounts are expressed as percentages.

The book falls into three main sections, Chapters 1 to 4 dealing with the history, chemistry, and properties of vat dyestuffs; Chapters 5 to 11 with the application of these colours, including a chapter on machinery; and finally, a section dealing with the identification of vat dyestuffs, with a fairly comprehensive list of analogous dyestuffs from various makers.

References to sources of information from other books and journals are given, and as stated above one of the most useful features of Mr. Fox's work is that he has made available in a handy form information from many scattered sources. The book is clearly printed and well produced, and will be a useful addition to the library of textile and colour technicians.

R. J. HANNAY.

Indian manufacture of mica, hitherto mainly exported as a raw material, is likely to develop as a result of a recent conference between the Interim Government and representatives of the mica industry. "We should take steps to utilise our raw materials ourselves," said the Member for Works, Mines and Power, advocating coordinated and systematic development of the mineral. Negotiations with the United States for the reduction of her tariff rates on Indian manufactured mica were also urged.

Entitled the "ABC of High Frequency Heating of Metals," a well-produced quarto brochure of 20 pages, effectively illustrated by line drawings, has been published by the electronic heating department of Philips Lamps, Ltd., Aboyne Works, Aboyne Road, S.W.17, from whom copies may be obtained. The purpose of the brochure is to explain the elementary principles and applications of the high frequency induction heating process from the practical point of view of works executives, managers and others.

PARLIAMENTARY TOPICS

"Call Up" of Technical Students

IN the House of Commons last week, Mr. Hicks asked why students at technical colleges taking a university degree course had been excluded from the Government's undertaking not to "call up" university students until after they had completed their course.

Replying, Mr. Isaacs assumed the students referred to were those who had started their courses under the age for "call up" and had been granted temporary deferment until the end of the following July in order to take certain examinations. No undertaking had ever been given that such students, whether at a university or a technical college, would not be "called up" until they had completed their course.

Lt.-Commander Gurney Braithwaite hoped that, in framing the new bill for compulsory service, the Government would bear this point in mind because, he said: "it is of the highest importance to our export drive that these young men should complete their education."

Mr. Walkden pointed out that some of our most successful "back-room boys" during the war were recruited from technical colleges and that many students were seeking a university degree. Could not the Minister grant the same facilities for external students as to full-time university degree students?

The Minister invited further information on the subject, but maintained that, taken by and large, the same treatment was given to technical as to university students.

Factory Developments

The total number of new factory buildings and extensions to existing factories (5000 sq. ft. and over) approved up to September 30, 1946, was 2236, to provide additional employment for approximately 340,000. This was stated by Mr. Belcher, for the President of the Board of Trade, in answer to Mr. Chetwynd.

Of these schemes, he further stated, 901 were in the development areas and should eventually provide employment for 201,000. Forty schemes had been completed in the development areas and should provide additional employment for some 5400.

Dismantling of German Factories

In the British zone of Germany, stated the Chancellor of the Duchy of Lancaster, Mr. J. Hynd, in reply to Mr. Molson, seven factories are in process of being dismantled; 35 more are scheduled for dismantling; and 398 others declared available for reparations but not yet allocated.

Mr. Hynd was also questioned by Mr. Birch and Mr. Molson regarding proposed dismantling and export as reparations at the factory of Mathes and Weber, Duisberg, producing soda for the manufacture of soap.

"The German chemical industry," Mr. Hynd replied, "is to be restricted under the present level of industry plan and this factory, which has been declared available for reparations, is on the list of those eventually to be dismantled and removed. It is, however, at present being maintained in production in view of difficulty in fully utilising other soda manufacturing plant in Germany."

Supplies of Lead

The total quantities of lead available in the last four quarters were given by the Minister of Supply this week, in answer to Mr. Byers, as follow:

	tons
1945	
Fourth quarter	81,189
1946	
First quarter	80,711
Second quarter	76,275
Third quarter	78,875

London Metal Exchange

Sir W. Wakefield asked the Minister of Supply when he proposed to free the metal market, to which the reply was that no decision had yet been taken about the re-opening of the London Metal Exchange.

Oil Plant, Dowlais

The Minister of Fuel and Power was asked by Mr. S. O. Davies if he would now reconsider his decision of three months ago to cease production at the oil plant, Dowlais, which rendered 180 men unemployed having regard to the fact that his reason no longer held good because no step had been taken to use the plant or any part of it for the purpose which he alleged necessitated its closing down.

Mr. Shinwell replied that the Minister of Food could not reconsider his decision to close this factory, which was originally taken on grounds quite unconnected with the supply of gas. The water-gas plants in the factory were still required in connection with the scheme for the supply of gas for local industry. He regretted the delay in beginning the work of adaptation. Three months ago the gas company was offered a loan under the Distribution of Industry Act covering the cost of the work and pressure was being put upon them to start the work without further delay.

The Royal Society

Awards of Medals

DISTINGUISHED chemists are among the latest recipients of medals awarded by the Royal Society.

SIR ALFRED EGERTON, M.A., B.Sc., F.R.I.C., F.R.S., who is Professor of Chemical Technology at the Imperial College of Science, secretary of the Royal Society and a past vice-president of the Institution of Chemical Engineers, receives the Rumford Medal for his leading part in

Sir Alfred Egerton

the application of modern physical chemistry to many technological problems. The Davy Medal has been awarded to PROFESSOR C. K. INGOLD, D.Sc., F.R.I.C., F.R.S., Professor of Chemistry at the University of London, for his distinguished work in applying physical methods to problems in organic chemistry.

The King has approved the award of the two Royal Medals for the current year to SIR LAWRENCE BRAGG, O.B.E., F.R.S., for his distinguished researches in the sciences of X-ray structure analysis and X-ray spectroscopy; and DR. C. D. DARLINGTON, F.R.S., for his distinguished researches in cytology and genetics.

Other medals awarded by the Society are: the Copley Medal to PROFESSOR E. D. ADRIAN, O.M., F.R.S.; the Darwin Medal to SIR D'ARCY THOMPSON, C.B., F.R.S.; and the Hughes Medal to PROFESSOR J. T. RANDALL, D.Sc., F.Inst.P., F.R.S

A new high-speed spot and switch welding machine for the production and assembly of light steel articles has been introduced by Philips Industrial (Philips Lamps, Ltd.). This has a capacity of 23 kVA giving welds up to $\frac{1}{8}$ in. added plate thickness. Speeds of up to 120 spot-welds per minute are obtainable on material of 18 s.w.g. thickness.

Personal Notes

SIR ALEXANDER FLEMING has been awarded the honorary gold medal of the Royal College of Surgeons in appreciation of his distinguished work and particularly in recognition of the part he played in the discovery of penicillin.

MR. NORMAN NEVILLE, O.B.E., director of the British Chemical Plant Manufacturers' Association and the Food Machinery Industrial and Export Group, is representing the British Engineers' Association at the congress of the Federation of Polish Engineers at Katowice, Poland, on December 1-3, when the economic reconstruction of Poland will be the subject of a series of papers.

Obituary

DR. DOROTHY JORDAN-LLOYD, M.A., D.Sc., F.R.I.C., director of the British Leather Manufacturers' Research Association, died suddenly at Great Bookham, Surrey, on November 21, at the age of 57.

The daughter of Professor Jordan-Lloyd,

Dr. Dorothy Jordan-Lloyd

of Birmingham University, she went to Newnham College, Cambridge, and was elected a Fellow in 1914. After doing biochemical research at Cambridge, she joined the staff of the British Leather Manufacturers' Research Association and was appointed director in 1927.

Among her researches was the study of the colloid chemistry of simple proteins, and, during the 1914 war, culture-media for bacteriological work. Her book on protein chemistry is a standard work.

When Dr. Jordan-Lloyd took charge of the Leather Research Association great strides were made in evaluating such factors as the tensile strength of leather, resistance to abrasion, flexibility, etc.

She was a past vice-president of the Royal Institute of Chemistry.

Home News Items

Plans for new penicillin factories are under consideration, according to Mr. A. L. Bacharach, of Glaxo Laboratories, Ltd.

A 17-years old employee died of burns following an explosion in the mixing department of High Speed Alloys, Ltd., Widnes, on November 16.

An Italian trade delegation is shortly leaving for London to negotiate an agreement with Britain, the Italian Foreign Minister has announced.

The sales department and counting house of Howard-Taylor, Ltd., 89, Kingsway, London, W.C.2, have been transferred to 94, Balham High Road, London, S.W.12.

At a chrysanthemum show at Rhos, North Wales, employees of Monsanto Chemicals, Ltd., won seven challenge cups out of nine, as well as gaining ten first, seven second and four third prizes.

Twenty firms have promised to exhibit at the exhibition of work done in Widnes, to be held on April 11 and 12 under the auspices of the Scientific Section of Widnes Society of Arts.

The Standards Department of the Board of Trade has been transferred from Boots Hotel, North Promenade, Blackpool, to Chapter Street House, Chapter Street, London, S.W.1. (Tel. VICtoria 7032).

A two weeks' course for women industrial welfare officers will be held at the National Recreation Centre of the Central Council of Physical Recreation, Bisham Abbey, Berks, from January 11 to January 25, 1947.

A lavishly illustrated brochure, entitled "A Record of War and Peace," has been issued by Siebe, Gorman & Co., Ltd., Neptune Works, Davis Road, Tolworth, Surrey, whose artificial breathing apparatus of all types is well known.

The Irish Alcohol Company has started its biggest production campaign since before the war. Its four factories are now working three eight-hour shifts six days a week. Potatoes, beet and Cuban molasses are being used simultaneously as raw material in the Cooley, Carrickmacross and Labbadis factories.

The Ministry of Agriculture and the Department of Agriculture for Scotland are now prepared to receive from manufacturers applications for the official approval of proprietary formaldehyde, metaldehyde, pyrethrum insecticides, derris-pyrethrum insecticides and tar-petroleum oil winter washes. Application forms may be obtained from the Secretary of the Advisory Committee, Plant Pathology Laboratory, Milton Road, Harpenden, Herts.

Speaking at a luncheon of the American Chamber of Commerce in London, last week, Dr. W. H. Coates, deputy chairman of I.C.I., said the U.S., which dominated the economic position of the world, could make the greatest contribution to peace by maintaining its own full prosperity and employment, by opening up its barriers to trade and by acting as a full creditor nation. "The new Congress," he said, "will, I fear, be apt to rely only on private enterprise and reject any Government co-ordination."

Fuel shortage caused principal Sheffield steel manufacturers to close departments for two or three days last week. Future economy in the use of coal, however, is likely as a result of the use of fuel-oil for steel making. Four 80-ton steel furnaces have already been adapted for this purpose by the United Steel Companies, estimated to save more than 50,000 tons of coal annually; and two storage tanks are being built at their Stocksbridge and Templeborough works, with a combined storage capacity of 1600 tons.

Overseas News Items

Final plans have been approved in India for the establishment of a Fuel Research Institute and a National Metallurgical Laboratory. A location has also been agreed for a National Chemical Laboratory.

The recent soap shortage in the U.S.A. has spurred the manufacture of synthetic detergents. It is reported that manufacturers plan to expand production to three times the 1945 level of 125,00,000 lb.

The rise in Canada's imports of chemicals and products is shown by the following comparative totals (in million dollars): January-December, 1939, 43.7; January-July, 1945, 46.4; January-July, 1946, 54.5.

The Canadian Rubber Control Board has reduced the price of crude rubber to Canadian manufacturers from 24.91 cents per lb. to 22.63 cents. According to Government sources, the reduction was made possible by the fact that the U.S. Government recently purchased 200,000 tons of crude rubber.

The Chosen Chemical Fertiliser Company has opened at Inchon, Korea, a sulphuric acid plant, the only one of its kind in the country. Production amounts to between four and five tons daily. The product is of 93 to 98 per cent purity and is used as dehydrating agent in the manufacture of chlorine.

American scientists working at the University of California have weighed the meson, the atomic particle produced in cosmic radiation. They found it has one-fifth the mass of the proton, the positive particle of the nucleus.

The production of coal-tar chemicals consumed by the plastics industry in the United States has made gradual progress towards a restoration of normal supplies, according to the U.S. Department of Commerce.

October exports of rubber from Malaya showed a big increase over the previous month, the total being 73,388 tons, against 57,579 tons. Shipments to U.S.A. ports totalled 33,471 tons, while those to the U.K. were 30,463 tons, and Australia took 2288 tons.

The world's highest iron-ore mine has recently been opened up on the slopes of the Pamir Mountains in Central Asia at a height of 8200 ft. It will be connected with the nearest railhead by a 15-mile funicular railway.

Exports of coal from the British zone of Germany are to be cut by 350,000 tons in December and in each month of the first quarter of next year—a sharp increase on the reduction of 150,000 tons already made in October and again this month.

An Austrian-Russian oil trading company has, according to an official Russian announcement, recently been formed in Vienna with an initial capital of 2,500,000 schillings. It will set up branches and depôts in all parts of the country.

According to the American Iron and Steel Institute, production of steel ingots and castings during October reached the peace-time record total of 6,970,000 tons. This was the fourth successive month in which production exceeded 6,500,000 tons.

From East Africa comes the news that recent rains in the Kilimanjaro area have produced an excellent flush of the pyrethrum crop, but some growers have been unable to handle it adequately owing to the labour shortage.

The United States War Department has announced arrangements with nine commercial concerns to operate 15 ordnance nitrogen plants for the production of nitrate fertilisers, to be shipped to countries devastated by the war. About 70,000 tons of ammonium nitrate are expected to be produced monthly.

The reported existence of important iron-ore deposits in the Karelo-Finnish S.S.R., now confirmed, will make it possible to establish an iron and steel industry in the neighbourhood of Leningrad. Before the war, Leningrad industrial concerns relied on iron-ore supplies from the Urals and Southern Russia.

A Swiss method of electric smelting, stated to result in an improved product, is being put into operation at the Emmaboda window-glass factory in South Sweden and is expected to yield a monthly output of 200,000 square metres of glass.

The formation in Canada of an industrial alcohol company, Reliance Chemicals, Ltd., has recently been announced by Distillers Corp.-Seagrams, Ltd. Production has already started in plant units strategically located to serve industrial sections in Canada.

Producing ammonia and ammonium-nitrate-ammonia solutions, the nitrogen plant at South Point, Ohio, has been purchased from the United States Government by the Solvay Process Co., a subsidiary of Allied Chemical and Dye Corporation.

Holland is to receive iron ore, pyrites, lead, antimony, mercury and other raw materials from Spain under a new commercial agreement signed in The Hague recently. In exchange, Holland will deliver dyestuffs and other chemicals, metal products, etc.

A higher-potency penicillin, announced by the Heyden Chemical Corporation of America, is stated to retain its active properties for three years without refrigeration. It is in a white crystalline form, with a reputed potency of 1667 units per milligram.

The purchase of foreign copper by the U.S. Government is to be discontinued forthwith. This action is reported to have been taken because of the elimination of price ceilings. The current 4 cents per lb. tariff on copper will continue to apply to private imports.

Accident prevention in industry is the subject of a course proposed by the Victorian State Government in Australia, the purpose being to enable industrial concerns to train their own technical men in safety technique and to organise their plant on lines that will minimise risks.

Despite a small rise in U.S. domestic production of potash between June last and March next—estimated at 792,706 tons as compared with 780,184 tons in the same period of 1945-46—the supply is not expected to meet more than 60 per cent of the total demands of commercial fertiliser companies.

Export of bulk penicillin is now permitted in limited quantities under licence from the U.S. Department of Commerce. Domestic requirements of bulk penicillin for processing into the non-injectable dosage forms have now been exceeded by production, which, as a result of the development of more productive mould strains, has increased beyond the industry's capacity to process into the injectable form.

NEXT WEEK'S EVENTS

MONDAY, DECEMBER 2

Oil and Colour Chemists' Association (Hull Section). Royal Station Hotel, Hull, 6.30 p.m. Mr. M. D. Curwen: "Naphthalenes in War-time."

TUESDAY, DECEMBER 3

Institution of Chemical Engineers. Geological Society's rooms, Burlington House, Piccadilly, London, W.1, 5.30 p.m. Mr F. E. Warner: "Nitric Acid Production."

Society of Chemical Industry (Plastics Group). Chemical Society's rooms, Burlington House, Piccadilly, London, W.1, 6.30 p.m. Mr. E. G. Hancock: "Synthetic Resins from Polyhydroxy Phenols."

Hull Chemical and Engineering Society. Church Institute, Albion Street, Hull, 7.30 p.m. Mr. Edwin Davis: "The Jointing f Non-Ferrous Metals and Alloys."

WEDNESDAY, DECEMER 4

Society of Public Analysts. (Jointly with S.C.I. Food Group). Chemical Society's rooms, Burlington House, Piccadilly, London, W.I, 6.30 p.m. Mr. D. J. Finney, Mr. W. B. Adam, Dr. K. L. Blaxter, Mr. E. H. Steiner: "The Application of Statistical Methods to Food Problems."

Royal Society of Arts. John Adam Street, London, W.C.2, 5 p.m. Dr. L. H. Lampitt: "William Jackson Pope—His Times."

THURSDAY, DECEMBER 5

S.C.I. Chemical Engineering Group (jointly with Bristol Section of S.C.I). The University, Bristol, 5.30 p.m. Mr. J. W. Carter, "Industrial Application of Activated Alumina to Adsorption Drying."

Chemical Society. Burlington House, Piccadilly, London, W.1, 7.30 p.m. Professor M. Stacey: "Macromolecules Synthesised by Micro-organisms" (the Tilden Lecture).

Society of Chemical Industry (Manchester Section). Engineers' Club, Manchester, 6.30 p.m. Members of the staff of Benger's, Ltd.: "Enzymes in the Food Industry."

Royal Institution. 21, Albemarle Street, London, W.1, 5.15 p.m. Mrs. Kathleen Lonsdale: "What Chemistry Owes to X-Rays—Pt. 1."

FRIDAY, DECEMBER 6

Royal Institite of Chemistry (Liverpool and North-Western Section) (jointly with S.C.I., Chemical Society and B.A.C.). The University, Liverpool, 6.30 p.m. Dr. J. P. Baxter: "Atomic Energy."

Royal Statistical Society (London Group). E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2, 6 p.m. Mr. W. Bennett: "Statistics in America—Factory Organisation."

SATURDAY, DECEMBER 7

British Association of Chemists. Adelphi Hotel, Liverpool, 3 p.m. Annual general meeting.

British Interplanetary Society. St. Martin's Technical School, Charing Cross Road, London, W.C.2, 6 p.m. Mr. John Humphries: "History of the 109-509 Rocket Unit."

Boring for oil in the Kimberley district of Western Australia will begin next April, according to a Commonwealth Government announcement. It is expected that the survey and drilling programme will extend from three to five years. A local company will soon resume drilling at Nerrima Dome, Kimberley.

Company News

The nominal capital of **Barrywald Products Ltd.,** manufacturers of electrical and chemical equipment, etc., 47, Oxford Street, W.1, has been increased beyond the registered capital of £500 by £3500 in £1 ordinary shares.

The nominal capital of **C.M.L. Ltd.,** research laboratory owners, etc., Ashley Green, near Chesham, has been increased beyond the registered capital of £100 by £4900 in 2000 non-redeemable cumulative preference and 2900 ordinary shares of £1.

The nominal capital of **A. Elder Reed & Co., Ltd.,** (226,982), chemicals, drugs, etc., 105, Battersea High Street, London, S.W.11, has been increased beyond the registered capital of £10,000 by £10,000 in £1 ordinary shares.

The nominal capital of **Diamond Fertiliser and Chemical Co., Ltd.,** 22/23, Corn Exchange Chambers, E.C.3, has been increased beyond the registered capital of £10,000 by £15,000 in 12,000 preference and 500 ordinary shares of £1 and 50,000 deferred shares of 1s.

New Companies Registered

Synthetic Chemicals Ltd. (223,986).—Private company. Capital £5000 in £1 shares. Manufacturers of and dealers in chemical substances, dyes, dyestuffs, paints, varnishes, etc. Subscribers: W. Hildreth, 80, North Park Avenue, Leeds, 8; K. Blackmore.

Chemical and Allied Stocks and Shares

STOCK markets have continued to reflect the search for investments offering larger yields than gilt-edged stocks. Although sentiment was unsettled by the latest UNO developments and profit-taking was in evidence in some directions, many industrial shares were again higher on balance. British Funds turned easier and selling of home rails was again reported, prices remaining below the "compensation" levels announced by the Minister of Transport.

After rising further to 44s. 3d., Imperial Chemical eased to 43s. 10½d., but Lever & Unilever at 51s. 6d. responded to the full results, and hopes of a higher dividend maintained firmness in Turner & Newall at 89s. 6d. On the other hand, the units of the Distillers Co. reacted to 137s. 6d. after changing hands up to 140s. United Molasses were 54s. 9d., British Plaster Board 33s. 6d. xd, British Drug Houses 58s., Fisons 60s., and Greeff-Chemicals Holdings 5s. ordinary 12s. 9d. B. Laporte were higher at £5, W. J. Bush 90s., Monsanto Chemicals 5½ per cent preference were quoted at 25s. 6d., Stevenson & Howell 5s. units at 31s., and Major & Co.'s 1s. units at 4s. 9d. Triplex Glass rallied to 36s. 9d. United Glass Bottle 87s. 6d. continued firmly held in view of higher dividend expectations, and Canning Town Glass 5s. ordinary were 12s. 4½d.

Iron and steels attracted buyers owing to the good yields still obtainable and the prevailing assumption that the industry is reprieved from nationalisation for about two years. Dorman Long at 27s. 3d. lost part of the rise which preceded publication of the financial results. United Steel were 26s. 3d., T. W. Ward 50s. 3d., Thomas & Baldwins units 11s. 3d., while in view of the unexpected increase in the interim dividend, Whitehead Iron & Steel were marked up 8s. 1½d. to 97s. 6d. Selective buying of colliery shares appeared to favour Bolsover (67s. 6d.), Hilton Main (47s. 6d.), Powell Duffryn (25s. 9d. xd), and Shipley (45s. 3d. xd).

In other directions, General Refractories 10s. ordinary have risen to 22s. on expectations that modernisation and expansion of the steel and other industries is likely to mean good demand for the company's products. Beechams deferred at 27s. 10½d. lost part of an earlier rise, but, in other directions, British Glues & Chemicals 4s. ordinary have further strengthened to 17s. 7½d. Low Temperature Carbonisation 2s. ordinary units have firmed up to 4s., and although best levels were not held in all cases, paint shares showed a number of good gains, Pinchin Johnson 10s. ordinary being 47s. 9d., while awaiting the dividend announcement, Lewis Berger have changed hands around £7. Electrical equipments were better with General Electric 103s., Associated Electrical 72s., while Crompton Parkinson strengthened to 34s. following news of the developments with the Austin Motor Co. in connection with electrical vehicles.

Borax Consolidated have been steady at 48s. 3d. reflecting continued hopes of a higher dividend for the past financial year. British Oxygen were good at 103s. 9d., with British Match 50s., and British Aluminium 45s. 9d. Boots Drug showed firmness at 63s. 6d., Timothy Whites were 47s., and Sangers 34s. Elsewhere, Morgan Crucible moved higher to 56s., and the company's preference shares were held firmly in view of their investment merits. De La Rue at 17½ have not held best levels and British Industrial Plastics 2s. ordinary were 7s. 7½d. with Erinoid 5s. shares 15s. Following earlier gains, oil shares were affected by international developments, Anglo-Iranian easing to 98s. 9d. after touching £5, while Shell reached 94s. 4½d., but went back to 92s. 6d., and Trinidad Leaseholds moved back following the dividend announcement.

British Chemical Prices

Market Reports

A STRONG undertone continues to be maintained in practically all sections of the London industrial chemicals market. The continued pressure from home consumers exceeds available supplies while the flow of inquiries for export is sustained. In the soda products section hyposulphite of soda and chlorate of soda are in active request and among the potash products there is a ready market for all quantities offered. Elsewhere there is little change to report. There is also nothing of outstanding importance to report from the coal-tar products market, where supplies are inadequate to cover all current demands.

GLASGOW.—Conditions in the Scottish heavy chemical market have continued to be extremely active during the past week with a heavy demand for all classes of chemicals and raw materials. Shortages are still observed in a large number of materials and the supply position shows signs of deterioration rather than of improvement. Prices on the whole are very firm, with increases recorded for zinc and copper products. In the export market inquiries and orders for sulphuric acid, soda crystals, caustic soda, Glauber salts, calcium carbide, aluminium sulphate, and copper sulphate have been prominent, but here again the supply position is deteriorating and manufacturers are quoting for delivery at longer and longer intervals.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Chlorohydrin.—E. F. Chandley, H. Steiner, E. Zimkin, and Petrocarbon, Ltd. 31759.

Colouring hydrophobic substances.—Ciba, Ltd. 31707-8.

Treatment of cellulosic materials.—J. R. Compton, P. W. Porter, and Celotex, Ltd 31647.

Carbon reactive bodies.—C. U. R. A. Patents, Ltd., W. J. Kramers, and M. Pirani. 31891.

Fermentation Processes.—Distillers Co., Ltd., and P. D. Coppock. 31419.

Polyethylenes.—E.I. Du Pont de Nemours & Co. 31722.

Pigmenting materials.—E.I. Du Pont de Nemours & Co., and F. W. Lane. 31885.

Purifying town gas.—L. Fassina, and L. Fassina. 31393-4.

Combustible gases.—Gas Light & Coke Co., M. Maccormac, and C. H. Lewis. 31733.

Azo compounds.—General Aniline & Film Corporation. 31828.

Polyvinyl chloride pastes.—Greenwich Leathercloth Co., Ltd., and R. G. Humphreys. 31395.

Carboxylic acids.—W. W. Groves. (Ciba, Ltd.) 31391.

Sulphonamide salts.—R. M. Hughes. (J. R. Geigy A.G.) 31632.

Synthetic resin sheets.—R. A. Kinnear, and I.C.I., Ltd. 31475.

Photographic emulsions.—Kodak, Ltd. 31777.

Organic compounds.—Mathieson Alkali Works. 31831.

Treatment of metals.—Metal-Gas Co. Ltd., and R. Hunter. 31399.

Steel, etc., hardening.—C. Morrell. 31660.

Catalytic reactions.—N.V. de Bataafsche Petroleum Maatschappij. 31639.

Dehydrosterol.—N.V. de Bataafsche Petroleum Maatschappij. 31490-1.

Selenium cells.—N.V. de Bataafsche Petroleum Maatschappij. 31916.

Hardening alloys.—N.V. de Bataafsche Petroleum Maatschappij. 31918.

Heat treatment of coal, etc.—Patent Retorts, Ltd., and T. M. Davidson. 31630.

Synthetic resins.—L. N. Phillips. 31833.

Extrusion apparatus.—J. W. Phipps, and I.C.I., Ltd. 31886.

Recovery of tungsten carbide.—E. A. Pokorny, and J. W. Pokorny. 31539.

Securing polyethylene, etc.—C. E. Richards, R. L. Bull, and H. F. Wilson. 31422.

Chemical testing apparatus.—Z. Roodyn. 31804.

Organic nitrogen compounds.—C. W. Scaife, and I.C.I., Ltd. 31476.

Alumina refractories.—C. Shaw, and W. E. Smith. 31772.

Catalysts.—Standard Oil Development Co. 31963.

Treatment of hydrocarbon mixtures.—Standard Oil Development Co., and J. C. Arnold. 31964.

Dicarboxylic acids.—Svenska Mjolkprodukter A/B. 31637-8.

Condensation products.—Tootal Broadhurst Lee Co., Ltd., J. T. Marsh, and J. Norbury. 31798.

Surface active agents.—Universal Oil Products Co. 31452.

Treatment of waste laundry effluents.—C. L. Walsh, B. A. Adams, and A.S.P. Chemical Co., Ltd. 31486-7.

Heterocylic compounds.—Wellcome Foundation, Ltd., S. Wilkinson, and F. C. Copp. 31354.

Piezoelectric crystal elements.—Western Electric Co., Inc. 31392.

Dehydro halogenation process.—R. S. Airs, P. J. Garner, and Shell Refining & Marketing Co., Ltd. 32353.

Heat resistant alloys.—Kanthal A/B. 32751.

Resinous compositions.—American Cyanamid Co. 32660-1.

Metal particles.—American Foundry Equipment Co. 32206.

Oil, etc., solidifying.—Barry, Ostlere, & Shepherd, Ltd., and R. P. Dryden. 32458.

Liquid pressure installations.—E. Bleibler. 32218.

Permanganates.—Boots Pure Drug Co., Ltd., and T. Hagyard. 32716.

Heat insulating materials.—British Celanese, Ltd. 32264.

Cellulose esters.—British Celanese, Ltd. 32265.

Oxazolidine derivatives.—British Schering Research Laboratories, Ltd., J. S. H. Davies, and W. H. Hook. 32403.

Treatment of fibrous materials.—Ciba, Ltd. 32073.

Esters.—Ciba, Ltd. 32552-3.

Monaryl-dihaalosilanes.—Dow Chemical Co. 32729.

Complete Specifications Open to Public Inspection

Methods of treating emulsions, in water or an aqueous medium, of vitamins, provitamins and vitamin or provitamin concentrations, soluble in fat.—N.V. Philips Gloeilampenfabrieken. March 4, 1943. 28257/46.

Nitriding process.—Nitralloy Corporation. April 28, 1945. 11564/46.

Phenolic-alkyd resins.—Norton Grinding Wheel Co., Ltd. April 26, 1945. 9262/46.

Polyhydric phenol-aldehyde resins used as adhesives in bonding plywood and the like. —Pennsylvania Coal Products Co. Oct. 19, 1943. 8851/44.

Alcohol dyeing.—Textron, Inc. 30539.

Dehydrating castor oil.—Universal Oil Products Co. 30107.

Edible oils.—Universal Oil Products Co. 30363.

Liquid dispensing.—G. Young, D. T. Laing, and J. H. Walls. 30495.

Lathering of colloid detergents.—L. Zakarias. 30476.

Polyhydric phenol-formaldehyde resin adhesives.—Pennsylvania Coal Products Co. July 15, 1943. 8852/44.

Polyhydric phenol-aldehyde resin adhesives.—Pennsylvania Coal Products Co. May 14, 1943. 8853/44.

Cellular glass and the formation thereof. —Pittsburgh Corning Corporation. April 24, 1945. 7112/46.

Glass mixtures and process of forming same.—Pittsburgh Corning Corporation. April 24, 1945. 8761/46.

Glass mixtures and process of forming same.—Pittsburgh Corning Corporation. April 26, 1945. 7259/46.

Determining the concentration of a substance in a mixture. Pittsburgh Testing Laboratory. April 24, 1945. 11633/46.

Production of alloys.—B. Stalhane. April 27, 1945. 12524/46.

Producing carbonyl compounds.—Universal Oil Products Co. April 28, 1945. 11473/46.

Aqueous solutions having a low freezing point.—Centrallaboratorium A/B. July 18, 1944. 28834/46.

Cellulosic products of improved wet strength and methods of producing same.—American Cyanamid Co. July 31, 1942. 7653/43.

Method of drying.—American Viscose Corporation. May 5, 1945. 12329/46.

Hydrocarbon wax compositions.—Atlas Powder Co. April 30, 45. 11464/46.

Calcining apparatus.—V. J. Azbe. April 13, 1945. 28367/45.

Production of cellulose derivatives.—British Celanese, Ltd. May 3, 1945. 12868/46.

Production of regenerated cellulose materials.—British Celanese, Ltd. May 1, 1945. 31046/46.

Production of cellulose esters.—British Celanese, Ltd. May 3, 1945. 13517/46.

Polysiloxane resin enamels.—British Thomson-Houston Co., Ltd. May 1, 1945. 13182/46.

Chlorinated methylpolysiloxane resins.—British Thomson-Houston Co., Ltd. May 5, 1945. 13364/46.

Treatment of chloromethyl-substituted polysiloxanes.—British Thomson-Houston Co., Ltd. May 5, 1945. 13365/46.

Chloromethyl silicon compounds.—British Thomson-Houston Co., Ltd. May 5, 1945. 13366/46:

Chlorinated methylchlorosilanes and their hydrolysis products.—British Thomson-Houston Co., Ltd. May 5, 1945. 13463/46.

Manufacture of corundum.—Cie. de Produits Chimiques et Electro-metallurgiques Alais, Froges & Camargue. April 30, 1945. 12845/46.

Processes of purifying crude metal phytates.—Corn Products Refining Co. May 2, 1945. 23919/45.

Hydrogenation of fatty acids and/or their glycerides.—De Nordiske Fabriker, De-No-Fa, A/S, and C. F. Holmboe. April 30, 1945. 23919/45.

Hardening fatty acids and/or their glycerides.—De Nordiske Fabriker, De-No-Fa, A/S, and C. F. Holmboe. April 30, 1945. 11981-2/46.

Preparation of tocopherols.—Distillation Products, Inc. May 8, 1941. 28519/46.

Vinyl halides and method of preparing same.—B. F. Goodrich Co. Jan. 31, 1945. 31246/45.

Gaseous materials.—B. F. Goodrich Co. May 1, 1945. 7554/46.

Production of polymeric organic compounds containing chlorine.—I.C.I., Ltd. June 17, 1942. 20499/43.

Bleaching processes.—I.C.I., Ltd. May 4, 1945. 13657/46.

Complete Specifications Accepted

Manufacture of 5-amino-acridine compounds.—May & Baker, Ltd., and H. J. Barber. April 6, 1943. 581,695.

Process for producing paraffinic hydrocarbons.—A. L. Mond. (Universal Oil Products Co.) July 5, 1944. 581,872.

Polythene films.—J. R. Myles, D. Whittaker, and I.C.I., Ltd. April 9, 1945. 581,717.

Process for effecting an abnormal addition of a hydrogen halide, hydrogen sulphide or a mercaptan.—Shell Development Co. Feb. 23, 1942. 581,775.

Catalytic dehydrogenation of hydrocarbons.—Standard Oil Development Co. Aug. 14, 1942. 581,745.

Inhibition of oxidation of mineral lubricating oils.—Standard Oil Development Co. Dec. 31, 1942. 581,747.

Inhibition of oxidation and like deterioration in mineral lubricating oils.—Standard Oil Development Co. Dec. 31, 1942. 581,783.

Liquid coating compositions.—A. Abbey. (Carborundum Co.) April 13, 1944. 581,940.

Manufacture of ethylbenzene.—J. C. Arnold. (Standard Oil Development Co.) Sept. 29, 1943. 581,907.

Production of carbon monoxide and gaseous mixtures containing it.—M. H. M. Arnold, D. R. Pryde, R. J. Morley, and I.C.I., Ltd. June 2, 1944. 582,055.

Adhesive compositions.—E.I. Du Pont de Nemours & Co. 32496-7.

Thermoplastic compositions.—E.I. Du Pont de Nemours & Co. 32672.

Hydrocarbons.—E.I. Du Pont de Nemours & Co., and G. M. Whitman. 32495.

Insecticides.—F. S. Dziecielewski. 32738.

Plastic compositions—W. Engel. 32192.

Hydrolysis of oils.—W. J. Fraser & Co., Ltd., and C. M. Auty. 32262.

Treatment of edible oils.—W. J. Fraser & Co., Ltd., and C. M. Auty. 32569.

Aqueous solutions.—P. Fróschel. 32726.

Gelatin compositions.—General Aniline & Film Corporation. 32521.

Beta-acyloxy halides.—B. F. Goodrich. Co. 32478.

Alkyl esters.—B. F. Goodrich Co. 32479.

Dicarboxylic acids.—B. F. Goodrich. Co. 32480.

Organic compounds.—W. H. Groombridge, and J. G. N. Drewitt. 32076.

Carboxylic acids.—W. W. Groves. (Ciba, Ltd.) 32072.

Ceramic pigments.—Harshaw Chemical Co. 32712.

Metal alloys.—H. J. Henbrey. 32686.

Aluminium alloys.—Humber, Ltd., and S. C. Clifford. 32494.

Filling of leather.—D. B. Kelly, L. E. Perrins, J. H. Sharphouse, and I.C.I., Ltd. 32180.

Polyvinyl compounds.—Kodak, Ltd. 32249.

Treatment of light metal.—Magnesium Elektron, Ltd., and E. F. Emley. 32504.

Metal composition.—Mallory Metallurgical Products, Ltd. 32193.

Polymerisation of compounds.—I. Marshall, I. Harris, K. B. Jarrett, and I.C.I., Ltd. 32178-9.

Separation of particles from gases.—W. F. Mode, and Traughber Filter Co., Ltd. 32277.

Heat-treatment of steel.—Morris Commercial Cars, Ltd., and S. S. Dodson. 32150.

Nitriding.—Nitralloy Corporaation. 32730.

Proteolytic enzyme recovery.—Novo Terapeutisk Laboratorium A/S. 32224.

Crotonic acid derivatives.—Organon Laboratories, Ltd. 32548.

Insecticides.—Pan Britannica Industries, Ltd., and E. J. N. Cakebread. 32014.

Chemical reaction apparatus.—V. F. Parry. 32700.

Rubber latex coagulants.—D. Outon-Powell. 32102.

Pentaenes.—Roche Products, Ltd. (F. Hoffmann-La Roche & Co. A.G.) 32725.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1432. | December 7, 1946 | Annual Subscription 21s. Overseas 26s.

Management and T.U. Leaders

FROM time to time we have discussed in these columns the management of businesses and we have stated our views upon the composition of the board of directors. We have not up to the present seen any reason to change the views that we have expressed in the past. The management of a modern business is an exceedingly difficult undertaking demanding teamwork of the highest order. The team must be carefully selected. If we were to base an analogy on sport, as the word "team" suggests we may do with propriety, we could point to the fact that every football team or cricket team is carefully balanced so that the right players are in the right positions. No professional football team could go on to the field without a goalkeeper, without full backs, or indeed without any member of the XI, each of whom is selected for his particular aptitude for the position and each of whom has specific functions to fulfil. Equally, a cricket team is a nicely blended mixture of fast bowlers, medium-paced bowlers, slow bowlers, steady batsmen, quick-scoring batsmen, and of course the inevitable wicket-keeper. The team that operates a business must be chosen with at least the same care as is taken in the selection or a professional football or cricket team. This analogy and the implications which it carries may appear to be too self-evident to demand more than the most passing reference. The fact, however, that chemical businesses are found which do not possess on their board a qualified chemist nor a qualified chemical engineer suggests that the lesson has not been learned. We should not say that it is wrong that the son of a director should himself be elected to the board in preference to employees having longer service. The background of the individual is most important. There are many qualified chemists and engineers who are excellent in the operation of their plants or in the performance of whatever duties are assigned to them, who yet do not possess the background of general experience and education or the necessary personal qualities to make them good leaders. The director must obviously do something more than give his opinion when matters of importance are brought before the board. He must initiate new proposals or new methods. There are in fact certain qualifications for holding a directorship which are not the technical qualifications necessary for successful operation of a process plant or for successful work in the laboratory. Nevertheless, the team that

On Other Pages

makes up the board of directors of any essentially technical industry is clearly unbalanced if it has not among its members technical men fully qualified to discuss matters on the highest technical level. Nor should we be satisfied if the possessor of these qualifications is an elderly man who has retired from more active participation in the industry. Knowledge rusts if it is not used every day. New ideas come forward which require live and active minds to appreciate them.

Perhaps never in the history of mankind have conditions changed so rapidly as within the lifetime of many of those who now hold senior positions in industry. Looking back on the conditions in the Edwardian era which preceded the first German war it is hard to believe that they were the commonplace of industrial life only 40 years ago. It is doubtful whether the changes in the upper stratum of business and industrial life have been as profound as those in the lower strata. It has often seemed to us that the composition of the boards of directors has changed very little in that period.

The professional, technical and managerial staff, however, has changed profoundly. Whereas the employment of men with university degrees was comparatively rare 40 years ago, it is now almost impossible to obtain a post of any importance on the technical side unless one has first-rate training and qualifications, generally rounded off by a university degree or membership of a senior engineering institution. With this improvement in quality there has come the need for still better leadership at the top.

But it may well be that the greatest change of all has occurred in the lowest stratum, *i.e.*, among the rank and file of the labour force. The spread of education has brought about a new appreciation of the possibilities of life.

Parallel with this change there has been an increase in organisation throughout industry. Wage earners are also more highly organised to-day than ever they were. There must be comparatively few firms today that do not employ trade unionists and as we have seen of late months there is an increasing effort on the part of the trade unions, an effort which appears to have the support of the Government, to make membership of particular trade unions a condition of employment in certain industries. It is quite evident that those who control the trade union movement are ambitious and are seeking to make their unions as strong as possible.

Preceding this change there was brought into office a different category of men as trade union officials, compared with the type of man formerly so employed. Trade union officials may still, of course, rise from the ranks with no special qualifications other than a thorough knowledge of their job, and the respect of their fellows. A very considerable number of trade union officials, however, have been at least as highly educated for their job as the management has for its job.

The trend to Socialism which has become so evident during the past few years has taken a form which we cannot help regarding as dangerous, namely, that representatives of the workpeople employed in industry have been put into the highest positions, presumably in their capacity as trade union bosses. These union officials have been put on the boards of nationalised industries, for example. The appointments may have been due to the sheer merit of those concerned, but the trend of events makes it appear likely that in every nationalised industry in the future the trade unions concerned will demand seats on the board for their nominees practically as a matter of right.

Serious as this position is with great nationalised industries controlled by Parliament it would, we believe, be even more serious if this sort of thing were to become common in firms operated by private enterprise. We do not take the view that because a man has been an official of a trade union he should not be given a seat on the board. Most trade union officials, however, have no experience of the management of industry or the management of any affairs other than those of their own trade unions. Industry should resist firmly any suggestion that trade union officials should be given higher managerial posts or seats upon the board. *as trade union officials*. The only reason why a man should hold a senior post of any kind is because he is fully qualified to hold it. There is an increasing tendency towards mixing politics with business, a tendency which is being brought nearer by nationalisation. We trust that this tendency will be firmly resisted in the interests of national efficiency.

NOTES AND COMMENTS

TIMELY CRITICISM

THE criticism of the "Britain Can Make It" exhibition by Sir Ernest Benn in his article on "Totalitarian Art" is timely. For too long the planners of this exhibition, backed by pressure publicity, have been patting themselves on the back and murmuring: "The designers planned it—all's right with the world." To Sir Ernest's criticism regarding the lack of makers' names and prices, can be added the comment that the exhibits differ little from those we saw in pre-war exhibitions. Then they were just shown in different, but less ugly and preposterous, positions. Another criticism frequently heard from the public inside the exhibition is that too many of the goods on show bear tickets stating that they are not available at the present time. Incidentally, the poor souls who queue up for hours outside the exhibition have got so used to queueing by the time they get inside that they continue to queue inside all round the walls, leaving the middle of the rooms free to anyone with the independent courage to do so to walk freely around. From the artistic point of view many of the exhibits would have pleased futurists—but that was hardly the purpose of the exhibition. We do not see that a piece of material looks any better by being draped over stag's horns than over, say, a chair. Nor do we see the necessity of detracting from the appearance of an exhibit by having a fearsome eye glaring at the visitor from the middle of the supporting structure. The exhibition was not the best advertisement of what Britain can do at this moment. We agree that Britain can make it, but what Britain can make best was not shown at the exhibition and what was shown there was not set off to the best advantage either of the buyer or the seller.

COPPER DEVELOPMENT

NEW uses for copper were indicated in the speech of Lieut.-Col. R. M. Preston, chairman of the council of the Copper Development Association at the annual general meeting of the association last week. Although, apparently, copper producers assume a shortage of the metal for the next two years, they have been looking forward to the time when more copper will be available. With this in mind the association has encouraged the use of copper in fields where little was previously employed. Among its successes must be ranked the fact that copper has now been accepted as a standard building material. The high efficiency, low maintenance cost and resistance to corrosion of copper tubing place it in a satisfactory competitive position compared with other metals. Among its other uses in the building trade are for damp-proof courses, flushings, weatherings, and for roofing. We understand that some houses have already been experimentally roofed with the metal. If this is a success, then we may expect to see many more buildings copper-roofed, and be able to say, with Hamlet, "here's metal more attractive." Although it must not be expected that the copper will remain long in its burnished beauty, those familiar with the copper roofs of the South Kensington exhibition buildings know the pleasant patina which it acquires after a few years.

FISHING BY RADIO

IF fishes of the sea imagined modern scientific weapons in the hands of aggressive humans hold no terrors for them in their watery depths there is likely to be a cruel disillusionment coming to them. Crews in their more leisurely moments of the late war discovered to their satisfaction and the fishes' cost that the method of detecting submarines by radio echo beam had also its usefulness as a means of locating shoals of the edible denizens. Now comes news of measures to make a business proposition of it. A beam can be directed from a fishing trawler to the bottom of the sea and, if fish are in the waters, an electrical reading is recorded in the engine room. Hundreds of ships on our west coast, it is announced, are being fitted with the necessary apparatus; and recently representatives from the Dominions, foreign embassies, Government departments, and commercial concerns saw a tank demonstration of the method, arranged by the British Export Trade Research Organisation. Already, we understand, 500 orders have been received from Scandinavian fishing interests for this apparatus, which will be exported at a cost of about £500 each. Makers claim that the apparatus "takes the guess-work out of fishing" and increases the rate at which catches can be made.

Totalitarian Art

by SIR ERNEST BENN

THE planners have enjoyed a fair field and plenty of favour in the matter of the ' Britain Can Make It " exhibition; indeed, the comparative immunity from criticism is in itself an indication of the distance travelled since it was our habit to do a little of our own thinking. I should be sorry to stand in the way of a shilling's worth of business by anybody and have, therefore, waited until this official effort at trade promotion has run long enough to expose its own absolute uselessness.

The Government went into the exhibition, or I would rather say peep-show, business in an extensive way, to keep up the spirits of war workers. It was rightly thought that the drudgery of repetitive work could be relieved by pictures, diagrams and demonstrations designed to show the direct relations between the small metal stamping and the actual fighting. Some of these temporary displays were real triumphs both in propaganda value and window dressing skill and, like Bill Gates and Workers' Playtime, kept up the spirits of our factory girls.

War Propaganda Tricks

All the tricks used with such success during the grim period of the blackout have now been transported to the Victoria and Albert Museum and exposed to the public as the bases on which the new British prosperity is planned. Plywood and cardboard are the first essentials; cut into shapes which positively shout their new-found freedom from all geometrical restraint, they adopt attitudes and angles so consistently awkward as to defy and defeat the unobservant. It is, it seems, a first principle of the brave new world that nothing must be erect, straight, upright or level. Next come buckets of colour wash mechanically sprayed over the surface of the cardboard; a couple of hidden electric lights give a glow to this tinted vacuum whose purpose turns out to be no more than to show a table spoon, tumbler, tooth brush or toilet roll—the psychologists are right in thinking that a dreamy sense of comfort is promoted by the total absence of the marks of work, effort or craftsmanship.

There is no attempt to sell, no pressure to buy. There are no firms, no name boards, no trade marks, no addresses and no prices displayed to view. The names of makers can be discovered only by the use of elaborate code number references. The all-pervading inference is that, given an official council or committee, all these things make themselves. Above all, the man who finds the money, conceives the enterprise, discovers the customers, keeps the staff together and shoulders the risks and responsibilities is a mere redundancy.

Behind and above it all is a well-planned attempt to secure control of the public taste, and great significance must attach to the hatching of such a plot within the hallowed portals of the Victoria and Albert Museum From the moment of entry the visitor is impressed with his own ignorance of art, his own inability to judge and his absolute dependence in all such matters upon the authoritative ruling of the official Council of Industrial Design. Every article and item exhibited has been approved and selected by a panel of " experts " and by inference every individual with an idea of his own has been warned off the course. This is the beginning of the "closed shop" in Art.

The Council of Industrial Design cares nothing for the fact that all over the world the demand is for British goods which bear the marks of British genius and labour. Nearly all the exhibits selected by them smell of machine oil and most of them could as well be made in Sweden, Switzerland or Saskatchewan. Evidence and marks of origin have been eradicated with a thoroughness almost equal to the Russian suppression of British and American signs from the implements of war. For a nation in need of exports this is childish stupidity; for a world relying upon a British trade mark it is a serious hardship.

World-famous Names Omitted

In the case of pottery and china, to take but one example, our bread and butter hangs on a number of famous names with unequalled reputations in design. To know through the efforts of the Council of Industrial Design that Britain can make utilitarian articles of serviceable shape and quality is interesting in its way, but of no help to millions of housewives all over the world, and especially in America, who have always invited their friends to admire their latest acquisition of Minton, Wedgwood, Doulton or other British brand of world renown.

If this is, as Sir Stafford Cripps declares, " British industry's first great post-war gesture to the British people and the world," then the British shop is indeed putting up its shutters.

For the purchase of insecticides and equipment for exterminating locusts, n appropriation of 9,000,000 dollars has been authorised by the Argentine Government, according to the U.S. Department of Commerce. Purchases will include 2,200,000 lb. of powdered locust insecticides and 8,300,000 lb. of poisoned bait.

BILLINGHAM ANHYDRITE MINE

Associated Chemical Plant

(From A Special Correspondent)

THE discovery of the deposit of anhydrite in a seam located directly underneath the I.C.I. plant at Billingham, Co. Durham, has been the prime factor in the development of a network of related chemical industries. The employment of this mineral as an essential agent in the manufacture of sulphuric acid, cement, ammonium sulphate, and "Nitro-chalk," constitutes a notable example of the efficient utilisation of an indigenous raw material in this country.

On September 24 and 25, through the courtesy of I.C.I., Ltd., members of the Institution of Mining and Metallurgy were afforded the opportunity of visiting the anhydrite mine and the sulphuric acid, cement, and ammonium sulphate plants. Mr. G. Eland Stewart, agent and manager of the mine, Dr. J. S. Dunn, and Mr. G. Child, of I.C.I. chemical staff, gave the members a preliminary account of the mine and of the chemical plants. These outlines were supplemented by a detailed description of the mine prepared by Mr. Stewart and published in the current number of the *Bulletin* of the Institution of Mining and Metallurgy (*Bull.*, No. 480, Sept. 12, 1946, pp. 11).

The visiting members from the Institution, including the president—Mr. G. F. Laycock—were conducted around the plant under the guidance of Mr. Stewart, Dr. Dunn and Mr. Child, and others of I.C.I. staff. Members were entertained to lunch and tea by I.C.I., Ltd., and after the tour there was an informal discussion, with questions, relating to the operations conducted in the various plants. The president of the Institution expressed the members' appreciation of the hospitality afforded and of the courtesies extended by I.C.I., Ltd., and the individual members of the staff.

In the following account of the mine and chemical plant, full use has been made of the paper presented to the Institution by Mr. G. E. Stewart. Data relating to the chemical plant was secured from the oral description given by Dr. Dunn and Mr. Child, by discussion and conversation at the plant and in the course of the visit.

One of the miners at the Billingham mine.

Discovery of Mine

In 1926 borings at Billingham disclosed the existence of an extensive deposit of anhydrite at a depth of 800 ft. below the factory site. This seam averaged 18 to 20 ft. in thickness with a 90 per cent. content of calcium sulphate. Until 1939, the underground workings proved the seam to have an average inclination of 1 in 19 in a direction S. 47° E., but in recent years great variations in the direction and dip have been encountered.

The mine is served by two 13 ft. diameter shafts lined with reinforced concrete. Hoisting of the rock in 4½ ton skips is effected through No. 1 shaft, while men, supplies, and steel are handled through No. 2 shaft. A winder built by Scott & Hodgson, with a 9-ft. diameter parallel drum gives a rope speed of 930 ft. per minute. The drum is driven by a 350 h.p. electric motor through two trains of double helical gears, Allen-West liquid controllers giving acceleration to full speed in 10 seconds. Average tonnage hoisted per shift of 8 hours is about 1000 tons. The cage winder at No. 2 upcast shaft is of similar construction.

Ore is transported from the workings to the shaft on a main haulage way, 18 ft. wide, which bisects the main workings and was driven to give a gradient of 1 in 80 in favour of the loaded tubs. Haulage of the 25-cwt. tubs in the main way is effected by two 6-ton English Electric trolley locomotives. A voltage of 250 is applied to the overhead trolley wires.

From the main locomotive haulage way rope haulage inclines 18 ft. wide and 9 ft. high are driven

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Right: Stoping a cross-cut in the Billingham anhydrite mine

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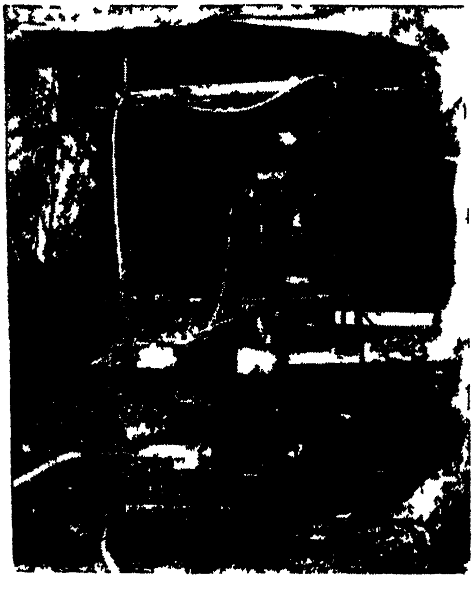

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Left. Diamond exploratory drilling

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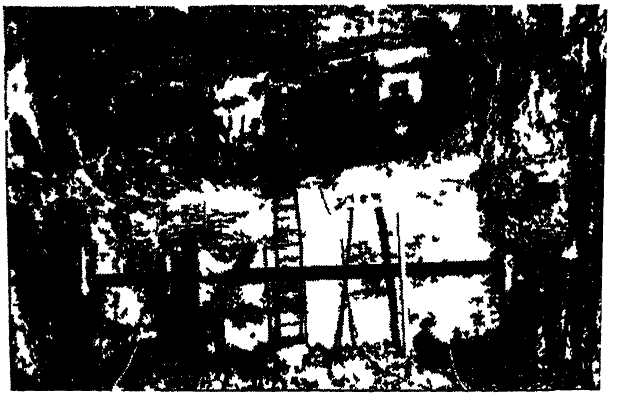

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Right : Top heading and bench drilling

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Left: 150 ton blast of top heading and bench.

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Right: Scraper loading.

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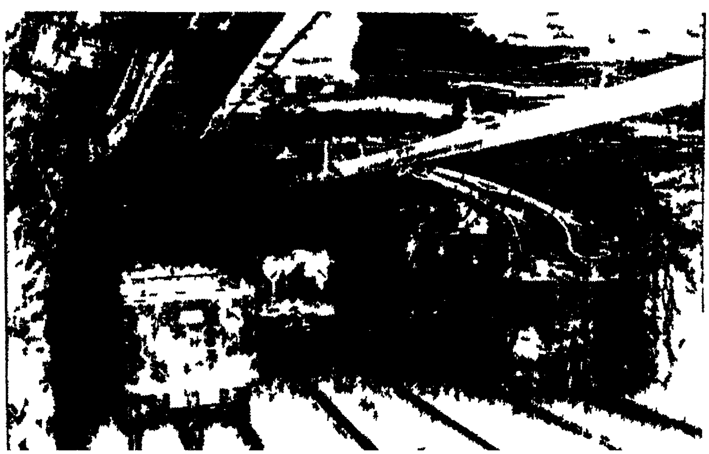

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Left: Pit bottom sidings.

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off to "rise" and "dip" at 120-yard intervals. The "dip" rope haulages are "main and tail" units, driven by 150 h.p. electric motors. A 60 h.p. motor with a two-speed gear has proved adequate for the "rise" haulage where power is required only to raise empty tubs.

Loading levels are turned off at 20-yd. centres from the inclined haulage ways, these levels being 18 ft. wide and the full height of the seam. To "rise" and "dip" of these loading levels cross-cuts are driven, 18 ft. wide, and at 20 yd. centres, so forming pillars 42 ft. square. Extraction is thus 51 per cent in plan area. Extensive pillars must be left as a large part of the factory plant is located directly above the mine workings and even very slight subsidence would give rise to serious mechanical difficulties in the plant.

Dry drilling of the rock is practised, any moisture causing the anhydrite to "set" hard. Considerable dust is thus produced in drilling, but systematic X-ray examinations of the miners has shown the dust to be innocuous. In the headers a correctly drilled round of shot holes will pull 7 ft. of rock, but a shorter round is drilled to pull only 5 ft. of rock in the cross-cuts.

Blasting of rounds of up to 50 holes is normal, using about 2¼ lb. of gelignite per hole. The holes are stemmed with extruded clay rods, consumption of explosive being about 0.6 lb. per ton of rock broken.

Broken rock is loaded into the tubs by scraper loaders operated by 30 h.p. electric motors. In pre-war years the scraper loaders averaged 205 tons per shift of 6½ to 7 hours working time, but with present labour and conditions the output varies from 140 to 160 tons per shift.

Ventilation is secured by a 13 ft. 6 in. diameter Walker indestructible fan located underground and exhausting 130,000 cu. ft. per minute to the surface. As the working face is now almost a mile distant from the shafts the dual problem of ensuring adequate circulation of air at the working face and of preventing leakage and expansion of the air into the old workings is demanding increased attention.

Reorganisation in Near Future

In his paper, Mr. Stewart points out that the mining methods presently employed at Billingham have remained fundamentally unchanged since the introduction of scraper loading in 1931. In view of the increased labour and working costs extensive reorganisation and modernisation of the mine will be undertaken in the future. Foremost among the features of the reorganisation scheme will be the introduction of "trackless" mining in accordance with some of the most modern developments in the U.S.A.

Run of mine anhydrite containing pieces up to 18 in. cube is tipped from the skips into a head-frame bunker of 100-ton capacity Feed from the bunkers is controlled by Ross Chain feeders, regulating the supply to Hadfields Size 7½ gyratory crushers which reduce to 3 in. cube. The gyratory crusher product then passes over rotary screens, the undersize from which (minus 1 in. cube) is stored in a 3000-ton bunker. The screen oversize is crushed to approximately 1 in. cube in Symons disc crushers which discharge to the 3000-ton bunker.

Transfer of the crushed and sized material to the sulphuric acid and cement plant is effected by belt conveyor and to the ammonium sulphate plant by overhead rope-way.

Sulphuric Acid and Cement Plant

The utilisation of anhydrite for the combined purpose of sulphuric acid and cement clinker manufacture constitutes an interesting and valuable industrial achievement. In the manufacture of cement clinker from calcium carbonate in the usual process, calcium carbonate is mixed with clay minerals—aluminium silicates and iron—and treated in a kiln to produce the clinker, the carbon dioxide liberated during the decomposition of the carbonate being drawn off with the kiln waste gases.

If anhydrite is substituted for calcium carbonate it is essential first to reduce the sulphate to some compound which will readily dissociate into lime with the liberation of sulphur dioxide. Carbon, in the form of coke, is the obvious choice of reducing agent, the quantity added being proportioned accurately to effect a complete reduction of the sulphate to the sulphite.

The lime produced on the decomposition of the sulphite reacts with the clay minerals and silica yielding the cement clinker. The sulphur dioxide, formed by the decomposition of the sulphite in the kiln is drawn off under suction and is employed for the manufacture of sulphuric acid.

An important feature in this utilisation of the anhydrite is that imports of raw materials such as pyrites and sulphur, employed in the more usual methods of sulphuric acid manufacture, are not required.

The sulphuric acid plant at Billingham is one of three in the world using anhydrite as raw material. A similar plant was operated in Eastern Germany, in what is now the Russian occupied zone. (This plant was visited by a team of investigators last year.) The third plant is situated in Southern France, but is not believed to be in operation at the present time.

As the sulphuric acid plant is situated in close proximity to the mine the anhydrite is delivered by conveyor belt to the storage hoppers. The other raw materials arrive in railway wagons which are discharged by grab into the storage hoppers. While the anhydrite from the mine is quite dry, the

other raw materials are treated in one of two rotary driers fired with coke-over gas, the dried products passing thence to main storage hoppers.

The dry materials are withdrawn from the storage hoppers by rotary tables feeding in turn to an automatic weighing and proportioning machine. This weighing machine is controlled by an electric impulse from a master controller.

The charge is then fed to 3-compartment tube mills for mixing and grinding. The ground "meal" is then fed to four blending hoppers, an analysis of the feed being carried out every two hours to determine the proportions of the more important constituents.

Passing by screw conveyors to the mill hoppers the meal is finally fed to the kilns by screw conveyors driven by synchronous motors. Adjustment of the speed of the synchronous motors enables a close control to be maintained on the feed to the kilns.

The Clinkering Kilns

Clinkering is effected in two kilns each 240 ft. long and about 9 ft. in diameter and fired with pulverised coal. Two interesting control features fitted to these kilns may be noted. A thermocouple is inserted near the smoke box, the terminals being coupled to stainless steel rings on the outer surface. Collector brushes enable the reading of the thermocouple to be transferred to an instrument on the kiln control panel. Also a gas-sampling device, consisting of two interconnected bottles is attached to the kiln near the same spot. Normally a gas sample is collected every half hour by clipping on the sampler which operates during one complete revolution of the kiln. The sample is analysed for combined sulphur dioxide and carbon dioxide and for oxygen content. The results are recorded on an illuminated board for the information of the operator on the control platform.

Very serious difficulties were formerly experienced with the lining of the kilns due to the corrosive nature of the charge and to the high sulphur dioxide content.

In view of the operating difficulties very close control of the process must be maintained and a large number of recording instruments have been assembled at the kiln control platform. These comprise a recording pyrometer giving the temperatures in the smoke box and in the back-end of the kiln. Dial indicators show the pressure in, and the gas-rate through, the kiln. The kiln speed is also indicated, the power required by the kiln driving motors and the pressure of the primary air to the pulverised fuel burners. These are supplemented by the half-hourly gas analysis figures from the back-end of the kiln, while further information is obtained by visual observation of the kiln interior and the discharged clinker.

Clinker, discharged from the kiln at a temperature about 1000° C. is fed through cooling tubes, secondary air for combustion being drawn through these tubes, counter-current to the flow of the clinker. From the coolers the clinker is discharged at a temperature of about 100° to 150° C. to a shaking conveyor which transfers the material to the storage hoppers. Final transfer of the clinker to the cement plant is effected by overhead ropeway.

Hot, dry, dust-laden gases from the kiln pass through a train of purifying plant under suction provided by the turbo-blowers in the sulphuric acid plant. A large percentage of the hot dust is thrown out by passage of the gas through a refractory-lined cyclone, the collected dust being returned to the storage hoppers. As there is a real danger of quantities of dust settling out and hardening in the hot flue between the kiln and the cyclone, a mechanically operated poker has been fitted. Electrostatic precipitators were formerly installed to treat the hot, dusty kiln gases, but these proved unsatisfactory and were withdrawn in favour of the cyclone and wash-tower arrangement now in operation.

Cyclone exit gases are cooled and washed with Tees river water in tile-lined towers packed with rings, the effluent being scrubbed with air to remove any traces of sulphur dioxide held in solution in the water. As the temperature of the effluent from the wash towers is maintained at 60° to 70° C. the loss of sulphur dioxide in solution is low. The presence of water and minute particles of dust in the washed gases leads to the formation of a dense mist which must be removed by treatment in Cottrell mist precipitators, the gases passing through two units in series. Final traces of moisture are removed by washing the cleaned and demisted gas with concentrated sulphuric acid in packed towers. After this treatment the clean, cool, dry gas, containing 6.5 to 7.0 per cent. of sulphur dioxide passes to the contact sulphuric acid plant through the blowers. There are two two-stage turboblowers, one to handle the gases from each kiln, each with a capacity of 25,000 cu. m. of gas per hour (approximately 900,000 cu. ft.).

Sulphuric Acid and Sulphate Plants

The contact sulphuric acid plant is of more or less standard design. Platinum, supported on silica gel carrier, is used in both the primary and secondary converters, although a vanadium catalyst is being tried out on one of the primary converters. Under present conditions the daily production of sulphuric acid is about 300 to 310 tons per day.

The interesting feature of the sulphate plant is the combination of the anhydrite

with ammonia to yield ammonium sulphate, replacing the more expensive sulphuric acid for this purpose. Further, the employment of the anhydrite yields a "chalk" product which may be utilised either in the manufacture of Portland cement clinker or in the production of the fertiliser "Nitro-chalk."

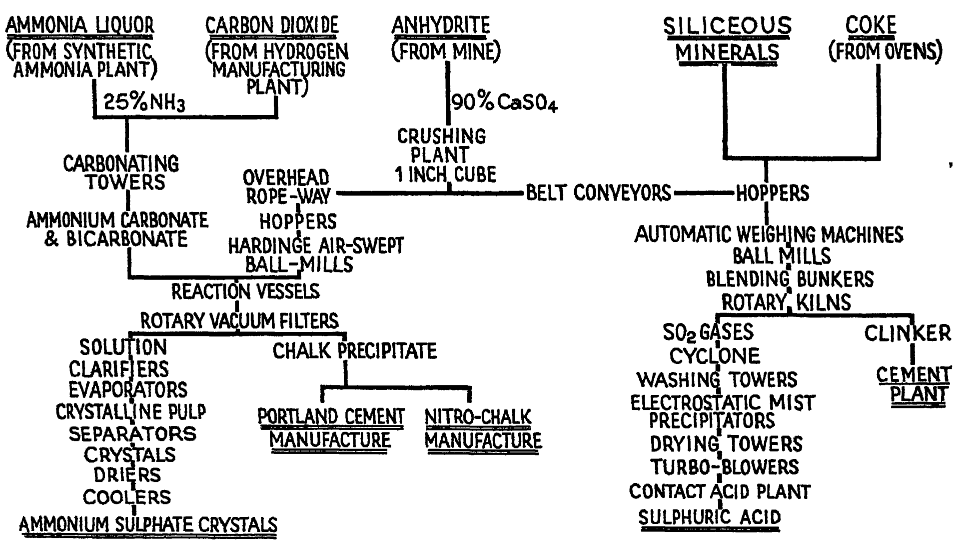
Raw materials for this process comprise anhydrite from the mine, ammonia from the synthetic plant, and carbon dioxide—a by-product from the hydrogen manufacturing plant.

Carbon dioxide from the hydrogen plant is made to react with a 25 per cent. ammoniacal solution in carbonating towers, the ammoniacal liquor being introduced at the top of the tower and carbon dioxide being fed in at the bottom. The final liquor, containing about 23 per cent. of carbon dioxide, is intermediate in composition between ammonium carbonate and bicarbonate.

Anhydrite, brought from the mine by overhead ropeway, is stored in large hoppers from which it is discharged to Hardinge air-swept ball mills. These are standard ball mills operating in closed circuit with an air-classifier. Air is blown into the mill from a fan, through a narrow central tube located at what is normally the discharge trunnion. Air currents in the ball mill pick up the fine material carrying it out in suspension through a large discharge tube, also located in the discharge trunnion. The air with the entrained dust then passes to the classifier, the coarser particles being returned to the feed trunnion of the mill. From the classifier the air, with the fines in suspension, passes to a cyclone in which the solids are separated. There is a make-up of atmospheric air drawn in on the suction side of the circulating fan and a corresponding purge to atmosphere after the cyclone. This purge is passed through bag filters to remove the slight traces of anhydrite dust left in the air.

Steel band conveyors then transfer the ground anhydrite to the reaction building. Here it is reacted with the ammonium carbonate solution, in cylindrical reaction vessels, of which there are eight in series. As the magma flows through the reaction vessels the reaction between the ammonium carbonate solution and the anhydrite goes practically to completion with the formation of ammonium sulphate and the precipitation of "chalk."

Separation of the chalk from the magma, together with the removal of as much adsorbed ammonium sulphate as possible from the precipitate is effected by two-stage filtration followed by clarification in settling tanks. Rotary vacuum filters, equipped with woollen filter cloths are employed for the two-stage filtration. Magma from the reaction vessels is pumped to the primary filters, the cake which forms being washed with the effluent liquor from the secondary filters. The dried cake, blown off the cloth by compressed air, is repulped with wash liquor from the secondary filters. Water, heated by low-pressure steam, is utilised to wash the cake formed on the



Diagrammatic flow-sheet illustrating the relationships between the anhydrite and the other raw materials and the inter-linked chemical plants.

secondary filters, the filter effluent passing forward to the primary filters for washing and repulping.

The cake from the secondary filters, mainly chalk with the insoluble impurities from the anhydrite and small quantities of adsorbed ammonium sulphate, is used in the manufacture of Portland cement clinker, for the production of "Nitro-chalk" or as a lime-dressing for agricultural purposes.

Strong hot liquor from the primary filters is clarified in settling tanks. Accumulated deposit from the bottom of the clarifying tanks is withdrawn at fairly lengthy intervals.

From the clarifying tanks the liquor is pumped to boilers to remove traces of ammonia and carbon dioxide. The vapours from the boiling liquor, consisting of steam, carbon dioxide and ammonia, are passed through a fractionating column and then through two condensers in series. The condensate from the first condenser is returned to the top of the fractionating column, while the ammoniacal liquor from the second condenser is recycled to the beginning of the process.

Crystallisation of the ammonium sulphate is carried out in single-stage vacuum evaporators with indirect steam heating. From the base of the evaporator the crystalline magma is pumped to a separator from which the crystalline fraction passes down to the "salt" filter. Final separation of the ammonium sulphate crystals is effected in a rotary vacuum filter. The crystal cake on the filters is washed with feed liquor while the filtrate is returned to the evaporators.

Final drying of the ammonium sulphate crystals is carried out in two rotary driers fired with coke-oven gas, the hot dry crystals then passing through two rotary coolers. Lifters are fitted to the internal surfaces of the coolers to expose the crystals to the air as much as possible, bringing about the maximum degree of cooling. The crystalline material from the coolers is then carried by band conveyor to an air-conditioned storage silo from which it is bagged for export.

Staybrite steel of the 18 chromium, 8 nickel, 1 tungsten, 1 titanium type is used very considerably in the construction of vessels and pumps on the sulphate plant.

(Photographs of the mine were kindly supplied by I.C.I.)

Industrial Poisons

Factory Inspector Describes Means of Protection

"PROTECTION Against Industrial Poisons" was the subject of a lecture delivered by Mr. H. C. Stephenson, B.Sc., A.R.C.S., M.I.Chem.E., at a meeting of the London Section of the British Association of Chemists on October 30. This was the last of a series of three lectures by H.M. Inspectors of Factories. Mr. D. Jackson, chairman of the section, presided.

The lecturer opened by saying that there were true internal poisons and toxic dusts. Most cases of poisoning were due to carbon monoxide—not to dangerous poisons such as hydrogen cyanide—and most of such accidents occurred in works other than chemical works, e.g., steel works. It was necessary to protect employees from contact with the poison under two conditions: (1) Plant normal, with the worker outside; (2) Plant under repair with the worker inside.

Dealing with the first condition, Mr. Stephenson suggested that substitution of the poison with safer material was the first thing to be considered. Red phosphorus had been substituted for the dangerous white variety and silica in grindstones, a former cause of silicosis, was not now a danger. Substitutes were now used for benzene, and in the pottery industry leadless glazes or glazes of low lead content were used.

The second point to consider was the escape of poisons. The prevention of dust could sometimes be managed by damping the powders in use; this was done in the manufacture of asbestos products, silica bricks and lead accumulators. Gas-tight plant could be employed, and the materials moved in pipes or by enclosed conveyors, etc. In the dry-cleaning industry, where trichlorethylene was used, completely-enclosed equipment was employed, so that the articles were not handled between entering dirty and leaving clean. Vapours could escape from loose joints, and openings were necessary for filling, etc. Sometimes plant was run at slightly reduced pressure so that any leaks would be into, and not out of the plant. Gas producers were now being run in this manner, using a booster pump after the plant. When producers worked above atmosphere, holes used for pokers might be fitted with air or steam jets on the outside, so that when the hole was opened the jet overcame any outward pressure of the gas.

Open bath degreasing could be dangerous if the condenser failed as the vapour poured over the vessel, and would gas workpeople in the vicinity. One such occurrence gassed 30 people, fortunately, none fatally. One protective system employed a thermostat placed just above the condensing pipe, so that if the condenser ceased to function the heating stopped. Special valves had been devised for the control of steam heating. In another system the water from the condenser was run into a tank having a ball valve,

which controlled the heating. The water chamber had a "bleed off" near the bottom, so that if the water failed the ball would fall, and cut off the heat.

Engine Exhaust Gases

A system employed for trapping exhaust gases from car engines was described. The engines were run for adjustments, while the chassis was travelling along the "belt." The exhaust pipe was attached to an extension pipe which passed into a trough in the moving floor. The trough had soft rubber lips which gripped the pipe and at the same time sealed the top of the trough. The latter was exhausted to atmosphere. A further method was the use of fume cupboards; slides were shown to indicate the many types available, from very small ones to fume cupboards the size of large rooms. In the latter case all the controls were outside the cupboard. During the war cupboards were designed suitable for holding carburetters used in aircraft while testing was in progress, and any "Ethyl" petrol which might spill was not a danger to the work people. In the case of lead melting, the cupboard was over the pot and was open at the top instead of the side.

In the grinding of "frit" for vitreous enamelling many examples of the use of draught occurred. Silica in sacks was emptied into cupboards and draught drew in any escaping dust. The trolley for empty sacks was brought very close to the opening and the empty sack transferred. The empty sack was later held against a large suction pipe and the suction pulled the sack inside out and removed any sand. The barrels into which the mixture was run were filled from a hopper having openings which just fitted the barrel, and any dust was drawn away by suction. The barrel was lifted into trunnions inside a cupboard fitted with a lid similar in design to the roll top desk, and was not tilted for emptying until the cupboard was closed. In some cases, as for example the charging holes of gas producers, or when lead burners were at work, close fitting hoods could not be employed. In such cases the draught should draw the air past the face of the worker before reaching the burner. The draught should not draw the fumes past the worker's face.

When men were working inside a plant very great care was necessary. The closing of a valve must not be relied on to protect the workmen. In one case a boy turned on a water gas valve by error when told to turn on a water valve. In another case a a vessel used for a process liberating hydrogen sulphide was connected to an exhaust main, so any leak through the closed valve should have been from the vessel to the exhaust system. Unfortunately, the fan stopped, gas escaped back into the vessel and two men lost their lives. Reliance should never be placed on a valve or a water seal, the latter might be broken by a surge. Although combination of the two ought to be safe, accidents had occurred through repair gangs emptying the water seal.

When sludge was present in a vessel this should be removed if possible and the tank seamed and blown with air before men entered. If complete removal was not possible, it should be assumed that the vessel was dangerous and breathing apparatus should be used. Movement of the sludge might liberate dangerous gases. Where the tank could be cleaned, the air should be tested, using the standard D.S.I.R. tests before men were allowed to enter. In the case of cyanide or carbon monoxide, a cage of mice or canaries should be kept inside the vessel while men were working.

The lecturer claimed that the tests for carbon monoxide used up to the present were cumbersome. Fortunately, a new test was devised during the war for use in the Royal Air Force, and this would shortly be available. This test was sensitive to CO in air to the extent of 30 ppm. when working with only 120 ml. of sample. The re-agent was potassium palladium sulphite, which was impregnated in silica gel; a black stain of palladium metal was obtained. Mr. Stephenson emphasised that workers not protected by breathing apparatus must not attempt rescue in cases of gassing. In one case twelve men were overcome trying to rescue one casualty.

Types of Breathing Apparatus

Breathing apparatus could be of a number of types, depending on its purpose. Self-contained types were available, using compressed air or compressed oxygen. With the latter the carbon dioxide liberated must be absorbed and means provided for cooling the air which was being re-circulated. These disadvantages did not apply to the compressed air types as the spent air was exhausted. Cannister respirators were available, but these should not be used in confined spaces or where the concentration of dangerous gas exceeded 1 per cent. A very important type of breathing apparatus consisted of a face piece, connected by means of pipe, to a supply of air; the slight air pressure ensured that a leaking face mask would not endanger the wearer. The air might be supplied by means of a pump, but now a very successful system was being rapidly extended. In this system, pipes containing air under pressure were run to all points where breathing apparatus might be required. The user need only plug in the flexible extension tube fixed to the face piece in order to obtain an air supply. A rducing valve was attached to the operator's belt to reduce the pressure of the air supply to a safe value.

Dutch Synthetic Ammonia Plant

Contract Given to British Firm

TWO contracts of considerable technical interest and exceeding £500,000 in capital value have recently been awarded to the Power-Gas Corporation, Ltd., of Stockton-on-Tees, by the Dutch Government organisation, Staatsmijnen, in Limburg (Dutch State Mines), under which is operated the great bulk of the coal industry in the Netherlands.

The larger project is to manufacture gas for ammonia synthesis in the correct proportions for chemical combination and purified to the fine limits required by the synthetic ammonia industry. The capacity is equivalent to the production of 180,000 tons ammonium sulphate annually for fertiliser purposes. The installation comprises four main sections for continuous operation 24 hours per day throughout the year, *viz*: (1) the gas generating plant, *using oxygen*; (2) the carbon monoxide conversion plant; (3) the carbon dioxide removal plant; (4) the final carbon monoxide and carbon dioxide purification plant.

The gas generating plant will use 180 tons per day of coal sized 60 to 80 mm. The gasification process, however, is such that fuel grading is immaterial and whether the coke size be 15 to 25 mm. for instance, depends simply on what is most economically available. A feature of special interest is that oxygen will be used in the fuel gasification, with a gasification efficiency considerably increased over standard water gas practice. The expected working costs in this use of oxygen, have been investigated thoroughly, and the Dutch State Mines are themselves installing an air-separation oxygen plant especially for the purpose of providing the necessary oxygen which the gasification process requires.

Gas-Making Plant

The technique of gas making plant design and operation is already proved industrially in previous plants built by Power-Gas Corporation. The basis is the producer gas continuous process, but using a flow of air, oxygen and steam to the gas generator. The amount of oxygen addition is such that the gas made, after its subsequent treatment, contains 99 per cent hydrogen and nitrogen in the accurate proportions of 3 : 1 for ammonia synthesis. The other constituents, such as argon, are inert in the synthesis process.

The gas making plant will comprise four generators, each to gasify 60 tons of coke daily and the gas produced will have approximately the following composition:

CO_2	CO	H_2	N_2	CH_4 + A
9.0	41.5	26.0	22.5	1.0

With this use of oxygen, the gasification efficiency is greatly increased over the ordinary water gas process, and will be about 85 per cent.

The gas produced, some 18,000,000 cu. ft. per day, will be treated with steam over a special catalyst in the second section for conversion of carbon monoxide, according to the well-known reaction:—

$$CO + H_2O \longrightarrow CO_2 + H_2.$$

The volume of converted gas is, of course, about 40 per cent greater than that from the gas generating plant, the quantity of hydrogen and of CO_2 being increased.

Removal of CO_2

The first stage of CO_2 removal is attained by scrubbing the gas with water, under a high pressure of about 190 lb. per sq. in. The water pressure is released in a water turbine for recovery of power, the water turbine being connected on the same shaft as the main water pump and its electric motor. On release of pressure, the greater part of the absorbed CO_2 is released, and can be collected for use elsewhere. A final regeneration of the water is obtained by circulating over a tower up which air is blown, before the water is taken by the pump for delivery again to the scrubbing tower.

In the synthesis of ammonia, harmful impurities must be of a very low order, and this applies particularly to CO, CO_2 and O_2. The gas is compressed to a much higher pressure (1800 lb. per sq. in.) and scrubbed with a liquor containing copper-ammonium salts in solution. This liquor absorbs carbon monoxide and also any traces of oxygen, as well as a great part of the residual carbon dioxide. The copper-ammonium liquor is regenerated by a special treatment, for use over again. The recovered carbon monoxide is, of course, returned to the inlet of the CO conversion plant. The final treatment is by scrubbing the gas, still at 1800 lb. per sq. in., with caustic soda solution, to remove the small amount of CO_2 that still remains. In this stage of purification, carbon monoxide and carbon dioxide are reduced to very fine limits, below 15 parts and 5 parts per million, respectively.

Each section of the plant is complete with ancillary machinery, and gasholders are provided where necessary.

The second contract is for a large modern producer-gas plant for firing a big new battery of coke ovens. The installation will comprise 7 units, each to gasify 50 tons of 60 mm. to 80 mm. coke daily. In this case too, the fuel most cheaply available is selected.

Electrodepositors' Technical Society

Review of Progress since its Formation

THE Electrodepositors' Technical Society is celebrating its 21st anniversary at a special meeting at the Northampton Polytechnic, St. John Street, Clerkenwell, London, E.C.1, today (Saturday).

The function is to begin with a soirée at 4.30 p.m., when members past and present will be able to meet together. During the latter part of the meeting a number of short speeches will be delivered by past and present officials of the society. The main speech is to be given by Mr. Samuel Field, A.R.C.S., the society's first president and formerly head of the Department of Applied Chemistry at the Northampton Polytechnic. Other former presidents of the society are expected to be present, including Dr. R. S. Hutton; Mr. E. A. Ollard, A.R.C.S., F.R.I.C.; Mr. A. W. Hothersall, M.Sc.; Dr. H. J. T. Ellingham; and Dr. J. R. I. Hepburn, as well as the present president, Dr. S. Wernick.

Early Days

The Electroplaters' and Depositors' Technical Society, as it was first called, was started in 1925, largely by the joint efforts of Mr. Samuel Field and the late Mr. William James. At the beginning, the society was sponsored by the Faraday Society, but today its name is probably as equally well known as that of the parent society. Its inaugural meeting was held at the Northampton Polytechnic on December 9, 1925. At the end of its first year its membership numbered about 120 and gradually increased to about 350 by 1939. After a slight decline in the early war years, its membership began to rise very rapidly until it now numbers about 800 members. About 40 per cent of the members live in or around London; some 30 per cent in the Midlands; 15 per cent in the remainder of Great Britain; and the remaining 15 per cent scattered abroad in Europe, America and the Dominions, with appreciable numbers resident in the U.S.A. and Australia.

Membership of the society is open to all persons with a *bona fide* interest in electrodeposition or cognate processes. Its members include practical platers and others engaged directly in the industry, together with approximately equal numbers of research and laboratory workers interested in the theoretical study of electrodeposition. The society's meetings, therefore, provide a forum at which the two sides meet and discuss their mutual problems.

After its second year of existence the society started the publication of a journal in which papers presented to it are published. Since then the journal has appeared regularly every year; Volume 20 appeared last spring and Volume 21 is due to appear in a few months' time. Papers presented to the society include papers on both research and the practical aspects of electroplating, electrodeposition and allied subjects such as anodising, phosphate coating, etc. The society and its journal have become the recognised media through which the more important work on electrodeposition is presented to the public; and nearly every important development in electrodeposition has quickly found its way to the pages of the journal. A large proportion of the research on electrodeposition by the Government Research Department (Woolwich), the British Non-Ferrous Metals Research Association, the Tin Research Institute, and the research departments of the leading producers of nickel, aluminium, etc., have been published through its pages.

The society holds regular meetings each month in London and Birmingham, where a local branch was formed in 1933. Except during the war years, the society has held an annual conference at Birmingham, at which two days are devoted to technical meetings, works' visits, etc. Through its standards committee the society co-operates on technical committees of the British Standards Institution in the preparation of standard specifications for electroplated, anodised coatings, etc., as well as specifications for plating chemicals and anodes.

Outstanding Events

Among the high lights of the society's activities was the organisation of a section on electroplating and electrodeposition at the Faraday Centenary Exhibition at the Royal Albert Hall in 1931. This was followed in 1935 by the organisation of the Electrodeposition Exhibition at the Science Museum, South Kensington, which was formally opened by Lord Melchett in the presence of a distinguished assembly of guests, including Sir William Bragg. The exhibition was open to the public for some 12 weeks and was visited by approximately 150,000 people.

In 1937, the society organised the First International Electrodeposition Conference and published a special volume of the Journal to cover its proceedings. This was followed a few years later by the Second International Conference in the U.S.A., organised by the American Electroplaters' Society. The Electrodepositors' Technical Society is now organising the Third International Electrodeposition Conference, which is to take place in London next May.

ROYAL SOCIETY MEDALLISTS

Work of Sir A. Egerton and Professor C. K. Ingold

IN the course of his presidential address at the 284th anniversary meeting of the Royal Society at Burlington House, London, W.1, on November 30, Sir Robert Robinson alluded to the work of the medallists.

Of Sir Alfred Egerton, who was awarded the Rumford Medal, he said: "He is a physical chemist whose researches have always been directed towards the application of physico-chemical principles to the process of combustion of hydrocarbons in all its ramifications. For some time the approach to combustion problems has been empirical because there was no satisfactory physico-chemical basis of the theoretical or practical aspects to make further significant progress possible. This background has now been partly provided by Egerton who was one of the first to see clearly how necessary it was to apply the new conceptions of combustion to the complex processes occurring under the conditions obtaining in internal combustion engines. One of the great obstacles to achieving greater efficiency is the difficulty of preventing premature detonation. This phenomenon is essentially a chemical one in the sense that organic peroxides, produced during combustion, are known to be responsible for the pre-ignition. Thus the chemical behaviour of peroxides might provide a key to the solution of the problem and much of Egerton's work has been devoted to this inquiry. The investigation involved the elaboration of special physical techniques since ordinary chemical methods were inapplicable to this type of research.

Cf National Benefit

"During the war Egerton has directed his attention to the vital problem of ensuring that combustion appliances should be devised and operated with the maximum possible efficiency. This can only be achieved by a thorough scientific analysis, hitherto lacking, mainly because the problem had hardly been considered worthy of serious study. The result of his labours cannot fail to be of great benefit to the country during the period of very low fuel production and will lead to considerable economies under all circumstances. The characteristic of Egerton's work has been the application of modern physico-chemical methods to current scientific and technical problems of great moment, combined with experimental researches developed with great ingenuity."

Speaking of Professor C. K. Ingold, to whom was awarded the Davy Medal, the president said: "Progress in one of the most active fields of chemical science during the present century has resulted from attempts to elucidate the detailed mechanism of organic reactions in terms of modern physical concepts. Throughout this development Ingold's contributions are especially distinguished. Possessing detailed knowledge and understanding of both the physical and organic branches of the science, he has been in a position to effect the synthesis

* Professor C. K. Ingold. *

of the two modes of approach without which a successful attack on the difficult, yet fundamental, problems involved could not be achieved. It is not possible in short compass even to outline the range of investigations with which Ingold has been concerned, but brief mention may be made of the work on stereochemistry dealing with ring strain and the effect of *gem* dimethyl groups on the valency angles of carbon. A further application of underlying physical principles is evident in his investigations of tautomerism in triad systems, and in the development of our ideas on ring-chain tautomerism.

"This work led on to more general studies of the mechanism of reactions, including the difficult question of substitution in the benzene ring, in addition to the ordinary reactions of organic chemistry, such as hydrolysis and substitution, which depite their apparent simplicity have proved to be complicated and difficult to interpret. The success which Ingold has achieved in interpreting these phenomena in terms of the electron theory of valency is striking, but in addition he has played the most prominent part in the experimental investigations which have led to our present knowledge of the kinetics and mechanism of organic chemical reactions. Ingold always has been interested in the elucidation of the course of chemical change by application of physico-chemical methods based on reaction

velocities and in this field may be cited the extensive work on the mechanism of substitution at an aliphatic carbon atom, leading to the recognition of the uni- and bi-molecular processes, by means of which so much has been done to solve the difficult problems raised by the Walden inversion and the phenomena of racemisation. In these intractable regions the contribution of Ingold and his school are of fundamental importance.

"Another aspect of his work involves a still deeper concern with physical principles as applied to organic chemical problems. His interest in the chemistry of benzene has led him to investigate in the fullest detail, using infra-red and Raman spectra, and indeed all available physical methods of approach, the fine structure of the benzene molecule. In order to provide the necessary data it was necessary to devise methods for the preparation of the various deuterium substituted benzenes—no mean feat of organic chemistry in itself—and the interpretation of the experimental results in terms of quantum mechanical principles has recently been published in an issue of the *Journal of the Chemical Society*, which he monopolised. Although his theoretical contributions have attracted more attention, the originality of his experimental technique is equally noteworthy and his happy selection of crucial tests amounts to genius."

Lever Brothers and Unilever Ltd.

Projected Developments in Africa

IMPORTANT developments of the natural resources of Africa and in local industry, which are now being carried out by Lever Brothers and Unilever, Ltd., were reviewed by the chairman, Mr. Geoffrey Heyworth, at the annual general meeting on November 29.

In the Belgian Congo, he stated, the company were completing the last stage of a programme, started in 1937, for the planting of 82,000 acres with oil palms and some 15,000 acres with rubber. When the last of the new palm plantations reached full bearing in eight years' time, 25,000 tons of oil a year would have been added to the 40,000 tons now being produced by the Huileries du Congo Belge Division of Huilever.

More Soap Factories

In tropical Africa the population's greater spending power had led to a higher demand for soap, which could be economically produced locally. The company had, therefore, decided to extend their soap factory at Apapa in Western Nigeria and to establish new ones at Port Harcourt and at Alberta in the Belgian Congo, while the existing factory at Leopoldville was to be extended. They would enter a new field by building a soap factory at Abidjan to serve the French Ivory Coast.

In East Africa, too, the time had come for the local manufacture of soap and edible products. The company's project was of special interest as establishing an ultra-modern industry in a relatively undeveloped area. In Uganda the principal crop was cotton, which, together with the seed, was transported by rail for shipment to world markets. They had decided, subject to Treasury consent, to put down a combined seed-crushing unit and soap and edible oil factory at Kampala, 800 miles from the sea, in the heart of the cotton-growing area. Its production of soap and edible oils would meet a substantial proportion of the requirements of Uganda and parts of Kenya and Tanganyika. The investment, estimated at £750,000, was necessarily large because the crushing of cotton seed, which had a relatively low oil yield, involved heavy capital expenditure in seed-crushing plant and because of the need to provide silos, water and electric power. The plant to be installed was of a design not previously operated outside highly industrialised countries.

In the Union of South Africa extensions to meet immediate demands for soap and edible products by the non-European population were under construction at Durban and Cape Town and would be completed in two years. The main item was the doubling of the company's oil milling capacity. The suspension of legislation banning the manufacture of margarine had made it possible to install a margarine plant at Durban.

Egyptian Expansion

Further expansion in Egypt, for many years a producer of oil from its cotton crop, depended upon the company being able to manufacture locally from Egyptian materials. They had decided to go ahead with their pre-war plans to build a modern soap and edible products factory in Cairo.

The chairman added that the company welcomed the Government-sponsored project for large-scale production of ground nuts in East Africa which, he said, would bring into bearing wide areas which otherwise could make no contribution to the world's productivity. This development by modern agricultural methods of large tracts at present tsetse-infested would by example direct thought towards the application of similar methods elsewhere in tropical Africa.

New Zealand Patent Law

Publication Changes

PROVISIONS for the publication of complete specifications of pending patent applications came into force in New Zealand at the beginning of October. The New Zealand law (Patents, Designs and Trade Marks Amendment Act, 1946) is not quite so severe as the Australian one (*see* The Chemical Age, September 14, p. 326). Complete specifications filed *after* the act comes into force will be published within three months of the date of filing the complete specification, but a delay may be granted on showing special reasons justifying the delay. Complete specifications filed *before* the coming into force of the new Act will be published eighteen months after the filing date of the basic foreign patent application in International Convention cases, and eighteen months after the actual filing date in non-Convention cases.

Prospective applicants for patents both in New Zealand and Australia will be well advised to have the question competently investigated whether such publication will affect their patent interests in other countries, bearing in mind that the benefits of post-war agreements and legislations such as the Anglo-French Agreement on August 29, 1947, and the Boykin Bill on August 8, 1947, will sooner or later cease.

Benyzl-Penicillin

Reported Synthesis

AN announcement in the American *Science* of the synthesis of minute quantities of benzyl-penicillin opens important new prospects of large-scale preparations of this material, as well as other penicillins not available by existing processes. This synthesis is the achievement of a team of British and American scientists after several years' work. Though it is not yet ready for production on a commercial scale, publication of this success is likely to stimulate interest in its development.

The article in *Science* explains how small quantities of benzyl-penicillin, sometimes known as penicillin-G, were prepared and isolated. Essentially, the article continues, reaction consists of a condensation between d-penicilamine hydrochloride and 2-benzyl-4-methoxymethylene-5(4)-oxazolone in pyridine containing triethylamine. In the second step this reaction product was made active biologically by heating in pyridine containing pyridinium chloride.

Concentration of the biologically active material is effected by extraction of the penicillinic acid from chloroform into a phosphate buffer of a *p*H of 5.2. This is followed by an 8-plate counter-current distribution of the active material between ether and the phosphate buffer at a *p*H of 4.88. After further concentration the material is subjected to a 25-plate counter-current distribution between chloroform and a phosphate buffer of a *p*H of 4.88. The crude triethylammonium benzyl-penicillinate is purified by crystallisation from ethylene dichloride by the addition of ether and subsequent recrystallisation from acetone.

The melting point, ultra-violet and infra-red absorption spectra, refractive indices, antibiotic activity, and specific rotation of the isolated synthetic material agreed within the limits of experimental error with those of the natural product.

Unfortunately, the mechanism of the reaction is still obscure. Consequently, this work cannot be used as proof by synthesis of the structure of penecillin. It was pointed out, however, that the new penicillin made possible by this type of reaction warrants increased investigation for possible use as antibiotics against organisms at present invulnerable to mould penicillins. There is evidence that the antibiotic activities of the condensates of *d*-penicillamine hydrochloride and 2-benzyl-4-methoxy methylene-5(4)-oxazolone with various α-amino-β-mercapto acids such as *d*-cysteine, the thiolthreonines and β-mercapto leucine indicate the synthesis of several analogues of penicillin

Prices of Unrefined Oils Increased

The Minister of Food has announced that owing to the increased cost of raw materials, increases have been made in the prices of unrefined oils and fats, and technical animal fats, allocated to primary wholesalers and large trade users during the four weeks ending December 28.

Among the increases, per ton naked ex-works, are the following: Coconut oil, by £31 to £80; palm kernel oil, by £30 10s. to £79; cottonseed oil, by £27 17s. 6d. to £80; groundnut oil, by £25 10s. to £82; palm oil (per ton c.i.f.): in returnable casks, by £16 15s. to £58 10s.; in drums on loan, by £16 15s. to £58; in bulk, by £16 15s. to £57. Acid oils: coconut and palm kernel, by £15 to £58 10s.; groundnut, by £15 to £55; soya, by £15; whale oil, hardened, by £15 to £54.

In Korea, the Janhang copper refinery is again smelting copper scrap and blister copper. Production of refined copper totals about 80 metric tons monthly and there are about 50 kilogrammes of gold in the sludge which will be melted into bullion as soon as hard coal is available. The Ilwon copper mine is to be reopened, while at the Orudong graphite mine approximately two tons of graphite concentrate (80 per cent carbon content) are produced per day.

PARLIAMENTARY TOPICS

Linseed Oil Shortage

IN the House of Commons last week, Mr. Hubbard asked the President of the Board of Trade whether, in view of increasing unemployment in the linoleum industry, he would allocate an increased tonnage of linseed oil to that industry from the amount made available by the Ministry of Food for industrial purposes.

Mr. Marquand replied that linseed oil allocations to using industries were determined by agreement between the departments responsible for those industries. Owing to the many claims on limited supplies, he saw no prospect of any increased allocation in the early future to the linoleum industry.

Brigadier Maclean later asked the Minister of Food how much linseed oil, or oil equivalent, was imported into this country during the twelve months ended October 31 last and how it was allocated as between different industries.

Dr. Summerskill, replying, stated that the oil equivalent of the linseed, together with the oil imported as such, during the twelve months ended November 2, 1946, was 98,757 tons. She circulated the following table.—

87,079 tons of linseed oil were distributed from Ministry of Food supplies during the 12 months ended 22nd November, 1946. The allocations were as follows:—

	Tons
Paint, varnish, putty, white lead	55,401
Linoleum	11,323
Core compound	8,321
Leathercloth, oilskins, tarpaulins, proofed cloth	3,009
Railways	2,668
Printing ink	2,281
Other uses, including adhesives, artists' colours, belting leather dressing, brake linings, builders' merchants, chemists, concrete hardeners, disinfectants, dockyards, engineering uses, hard board, oiled paper, pottery, rubber substitutes, sealing compounds, soft soap, ships' stores, sulphonation, textiles, veterinary purposes, wall covering	9,076
	87,079

In reply to Mr. Hubbard, who asked whether there could be an increased allocation of linseed oil for the linoleum industry, Dr. Summerskill said she regretted that stocks would not permit an increase in the overall rate of usage of linseed oil at present. She added that, unfortunately, India had prohibited the export of linseed and that it had been difficult to acquire any in the Argentine.

Dr. Summerskill agreed with Colonel Ponsonby that it might be true that the allocation to industry was only 20 per cent of the pre-war supply, but, she pointed out, the allocation was decided by a committee.

The Minister of Fuel and Power was asked by Sir G. Fox if any reliable estimate had been made of the percentage of the world's proved and potential oil reserves under British ownership or control.

There was no means of assessing potential oil reserves, Mr. Shinwell replied, and estimates of proved reserves varied considerably; moreover, fresh reserves were discovered from time to time as the delimitation of existing and new oilfields progressed. Consequently, it was not possible to make any accurate estimate of the world oil reserves or of their territorial distribution. On such evidence as was available he was advised that the oil reserves in British territory or operated by British interests under concessions in foreign countries probably represented between 20 per cent and 25 per cent of the proved world oil resources.

Steel Production

The Minister of Supply, replying to a question by Col. Stoddart-Scott, said that provided transport and fuel were available, about 2,300,000 tons of finished steel, the approximate equivalent of 3,300,000 ingot tons, should be produced in this country in the first quarter of 1947. About 250,000 tons of finished steel might be exported. After allowing for imports, supply would probably fall short of estimated demand by about 500,000 tons.

In reply to a further question by Mr. Warbey, the Minister said that until the proposed new continuous strip mill came into operation, the problem of increasing sheet steel production was primarily one of attracting more labour to the older hand-sheet mills which were concentrated during the war. His department was in close touch with the Ministry of Labour, the industry and the trade unions concerned, and special arrangements had been made by the industry for the training of new entrants and for the payment of a bonus above the unskilled rate to trainees retained in the industry.

German Potash

Questioned by Mr. Medlicott concerning the output of the potash mines in the British zone of Germany, Sir Stafford Cripps said no potash produced in the British zone was at present being exported, but intimated that Britain, in common with other European countries, was due to receive a share of the exportable surplus of potash produced in the eastern zone of Germany and that the necessary arrangements had now been made with the Russian authorities.

Metallurgical Section

Published the first Saturday in the month

Metallurgical Section

December 7, 1946

ALLOY STEEL ANALYSIS

QUANTITATIVE DETERMINATION OF HEAVY METAL OXINATES

by W. G. CASS

IN a recent paper by R. Niericker and W. D. Treadwell, of the Dept. of Inorganic Chemistry, Zürich University (*Helv. Chim. Acta,* 1946, *29,* fasc. sext. Oct. 1, pp. 1472-1483) previous work on the use of tungsten and other oxinates in alloy steel analysis is reviewed and further research reported. It is pointed out that, among the heavy metal oxinates which have become important in analysis of alloy steels, those of tungsten, molybdenum, and vanadium exhibit a marked precipitative sensitivity. According to Hidehiro Goto (C 1938 II, 1821, C = Chem. Centralblatt) iron oxinate with *p*H 2.8 – 11.2 may be quantitatively precipitated, and according to R. Berg (*Z. an Chem.* 1929, *76,* 199) the precipitate can be weighed as such, titrated with bromate, or heated to oxide. Similar suggestions for determination of W, Mo, or V, with 8-oxyquinoline are only imperfectly known.

Tungsten oxinate may be determined by heating and reducing to WO_3 (A. Jilek *et. al., Collect. Trav. Chim. Tchec.,* 1933, *5,* 136). The method was tested by S. Halberstadt (*Z. an. Chem.,* 1932, *92,* 86) and S. S. Muchina (*C.,*1929, *I,* 743) for steel analysis. They recommended also weighing of the yellow precipitate dried at 130° C., if, when precipitating, the neutral or slightly alkaline solution heated to b.p. is acidulated with acid only after addition of a suitable amount of oxine; or if the oxinate is precipitated from a strongly acid tungstate solution by buffering with ammonium acetate only after addition of a sufficient amount of oxine.

Acidity in Precipitation

According to H. R. Fleck (*An.,* 1937, *62,* 378) the acidity in precipitating tungsten oxinate is *p*H 4.95 — 5.65. E. Otero and R. Montequi showed that, in precipitating tungsten oxinate in the cold the composition of the precipitate varies with acidity, but it is finally tungsten oxinate after heating with oxine (*C.,* 1936, I. 4600; 1938, II, 1821). They obtained, by heating and addition of 8-oxyquinolate to a tungstate solution already acidulated, a precipitate $WO_3(C_9H_6ONH)$. S. Ishimaru (*C.,* 1938, II, 1821) studied the effect of phosphate ions on precipitation of tungsten and other oxinates such as those of Mo, V, and Fe, and found that small additions of phosphate ions had no effect; but according to the present authors precipitation may be markedly hindered by addition of strong phosphoric acid. R. Berg (*loc. cit.*) said that the quantitative determination of tungsten oxinate is not possible. More recently, J. A. Merz (*C.,* 1942, I, 1030) recommends precipitation of the tungstate from neutral solution with excess of oxine acetate solution and determining excess of reagent.

Conversion Methods

A citrus yellow precipitate of molybdenum oxinate, according to G. Balanescu (*Ann chim. appl.* (2), 1930, *12,* 259) may best be weighed after drying at 130° H. R. Fleck *et. al.* (*An.,* 1933, *58,* 388) give the acidity range of the precipitation as *p*H = 3.70 –7.40; and in a quantitative precipitation according to Hidehiro Goto it is 3.3 — 7.6. There appears to be nothing in the literature about conversion of the oxinate to MoO_3 which is markedly volatile from 480° C. upward. G. Balenescu says (*loc. cit.,* that the molybdic oxinate is soluble in concentrated sulphuric acid, and after dilution may be titrated bromometrically with quantitative exactitude. According to R. Berg (*loc. cit.*) it is better to dissolve in 4N caustic soda and then pour the solution into concentrated HCl. After dilution with water the oxine solution may be bromometrically titrated.

A. Jilkek *et. al.* assert that (*Chem. Listy,* 1932, *26, 1*) an alkali vanadate may be precipitated with oxine as a black deposit and reduced by heating to V_2O_5, giving fairly exact results. K. Shiba, in work cited by S. Ishimaru (*loc. cit.*), was able to separate vanadic acid from 3 per cent acetic acid as vanadic oxinate, and by weighing the precipitate dried to 130° C. obtained very precise results. According to H. Goto (*loc. cit.*) the acidity range is pH=2.7–6.1. J. A. Atanasiu *et al.* (Z. an. Chem. 1934, *97,* 102) tried to get the end point of bromometric titration by electrometric methods, but without success.

As starting material for the following determinations 0.1 m. solutions of very pure sodium tungstate, $Na_2WO_4.2H_2O$, ammonium molybdate $(NH_4)_6Mo_7O_24.4H_2O$, sodium vanadate $NaVO_3.4H_2O$, and ferric chloride $FeCl_3.6H_2O$, were used, the titre of which was ascertained by numerous control tests. As shown in the following it was possible to precipitate quantitatively and simultaneously the above-named acids and the iron (III) ion within pH limits of 5.0-5.5. If the weakly acid solution is treated with oxine, tungstic acid, for example, is thrown down as a blood-red precipitate of composition $WO_3(C_9H_6ONH).4H_2O$. It is, however, recommended to precipitate as tungsten oxinate $WO_2(oxin)_2$ by treating the neutral to alkaline solution with excess oxine (50—200 per cent) and heat solution to boiling point. $WO_2(oxin)_2$ forms only in the hot solution, and the precipitate obtained from hot solution is much more easily filtered. During filtration the solution should not be allowed to cool, thus ensuring that there is no separation of precipitating agent.

Measured amounts of the original solution were diluted to 100-200 cc. and 2-n NaOH added up to pH of 7.3. Solution was heated to b.p., and a 4 per cent solution in 50 per cent alcohol was added in excess up to 100 per cent. $MoO_2(oxin)_2$ separated out whilst $WO_2(oxin)_2$ and $V_2O_3(oxin)_4$ remained in solution. In order to precipitate all the oxines, solution was acidulated by addition of 2N acetic acid to pH 5.0=5.5, and again heated for five or ten minutes to compact the precipitate, which was then quickly filtered and the hot filtrate washed with hot water three or four times. For washing out the denser precipitates of Mo oxinate (oxine or oxyquinolate) and tungsten oxinate 5-10 cc. of water was sufficient; but for washing out the vanadium oxinate about ten times as much water is necessary. The precipitates were dried to constant weight at 120-140°C. and weighed. Contrary to the statements of E. Otero and R. Montequi (*loc. cit.*) the presence of small amounts of ammonium ion representing 1-5 cc. of concentrated ammonia did not disturb precipitation.

Result of Tests

As a result of a large number of tests S. Ishimaru (*loc. cit.*) found that all oxine precipitations hitherto were not affected by the presence of 200 mg. phosphate ion per 200 cc. of solution; but the present authors were able to precipitate quantitatively tunstic acid from oxine solution in the presence of 0.01-m phosphoric acid by neutralising to $pH = 5$. With 0.1-m phosphoric acid only partial separation occurred, and with 1-m phosphoric acid it was completely inhibited.

Total precipitation of tungstic, molybdic, and vanadic acids together with iron (III)-ion, as oxyquinolates (oxines) may be achieved, therefore, as follows: The mixture together with 0.01-m phosphoric acid is heated to b.p. and 50-100 per cent of 4 per cent oxyquinolate solution in 50 per cent alcohol added, buffered with saturated solution of sodium acetate to $pH = 5.3$. The solution is kept boiling for a few minutes until the precipitate has caked together, and is then filtered, rinsed together with the hot filtrate, and washed with as little hot water as possible, dried at 120-140 and weighed Tabulated results show very close agreement between calculated and found.

Corresponding Oxides

In order to convert the oxy-quinolates at moderate temperature (below 500°C.), to avoid loss of volatile MoO_3, into the corresponding oxides, the oxyquinolates must first be broken up by acid or basic decomposition.

(a) *Molybdic oxyquinolate to oxide*: After decomposing with oxalic acid—416 g. of the oxyquinolate were mixed in a Gooch crucible with five times the amount of damp powdered oxalic acid and heated for 60 min. at 150° in vac., whereby the oxyquinolin and oxalic acid almost completely sublimated in the cold part of the tube. There remained a brownish oxide which was heated to constant weight at 480°C. for about two hours, and the dark colour persisted. Its weight corresponded to theoretical.

(b) Conversion of oxyquinolate to oxide, after decomposition in ammonia. Weighed quantities of molybdic oxinate were heated for 30 min. at 330° in a wet ammonia stream and then kept during a similar period in an air current at the same temperature. At about 270° the precipitate became dark-coloured. The oxyquinolin distilled off for the most part unchanged, and the precipitate was then heated in an electric oven for 50 min. at 480°, whereby pure yellow MoO_3 was obtained. On further heating for five hours at 500° 416 mg. of oxide showed a loss in weight of 0.2 per cent. To decompose the oxine precipitate the filter glass was placed in a Jena tube, wet ammonia gas passed through, and the glass heated in an air bath to 330°. In the same way tungsten oxinate, vanadium oxinate, and iron oxinate were converted into oxides; and the same could probably be done also with the oxinates (oxyquinolates) of cadmium, gallium, and indium.

The oxyquinolates of vanadium and of iron easily dissolve in warm dilute phosphoric or hydrochloric acid; and also more slowly in cold 2N HCl. But those of molybdenum and tungsten, on the other hand, can only be dissolved in warm concentrated phosphoric acid. Directions for preparing a solution are given, and to this was added 5 cc. HCl (1 : 1) and 1 g. KBr titrated

with 0.1-n potass. bromate, using a bare Pt wire as electrode. Titration should proceed slowly towards the finish and the final figure is always about 1.1 volt, whereas the initial potential varies widely acording to the nature of the cation portion. With vanadium this is only about 0.2, with tungsten 0.65, and with molybdenum 0.35. With a pure oxine solution with bromate the original potential is about 0.95. Pure oxyquinolin may also be sharply titrated in 4-m phosphoric acid.

Titration Possibilites

For reduction tests with cadmium a tube of 18 mm. inside diam. was filled to about 150 mm. of its length with fine electrolytic cadmium tinsel. Preliminary tests had shown that acidulated oxine solutions, even with slow passage through the cadmium reductor, are not reduced. The cation part of many oxine solutions may, therefore, be reduced in the reductor and then titrated. The presence of oxine in such case affected the reducibility of tungstic acid in characteristic manner. In electrometric titration with bromine the reaction usually proceeds with the reduced cation, and with the oxyquinolin in two sharply separated stages so that there are thus new different titration possibilities. The test in each case was made in 1-m phosphoric acid, and some results are as follows:

1. 10 cc. 0.01-m Na_2WO_4 was passed slowly through the reductor in a completely air-free nitrogen atmosphere, and was quantitatively reduced to the W(V) stage, using 10.02 cc. 0.01-n potass. bromate.

2. 5 cc. 0.01-m $WO_2(oxin)_2$ required for the oxine present 30.97 cc. potass. bromate. Contrary to the foregoing case the phosphoric oxine solution was not reduced. Electrometric titration with bromate showed only the amount required for bromination of the oxine, namely 39.95 cc.

3. 10 cc. 0.01-m $(NH_4)_6Mo_7O_{24}$ was reduced to Mo(III) stage using 29.95 cc.

4. 10 cc. 0.01-m $MoO_2(oxin)_2$ for the oxine radicle required 8.02 cc. potass. bromate.

5. 10 cc. 0.001-m $MoO_2(oxin)_2$ was passed for twenty minutes through the reductor, rinsed with a little dilute sulphuric acid and titrated, the bromine being used in two stages: for Mo(III) to Mo(VI) 2.98 cc. was required, and for bromination of the oxine up to the second and sharper potential 8.03 cc., thus indicating that the $MoO_2(oxin)_2$ is quantitatively reduced to the Mo(III) stage.

The dried and weighed oxyquinolates, after decomposition in ammonia stream, could all be easily converted into the corresponding oxides of tungsten, molybdenum, and vanadium; and these oxides, heated to about 480°, are readily dissolved in warm 2-N sodium hydroxide, MoO_3 was also easily soluble in concentrated ammonia, while WO_3 and V_2O_5 were only difficultly soluble. In the presence of iron the solvent may be phosphoric acid with possible addition of HCl. The oxide solutions thus obtained may now be used for fresh oxine precipitation. Bromometric titration was done with phosphoric solutions of the filtered precipitates. In this way various indirect determinations could be used, especially for the systems W-Mo, W-V, and Mo-V. In carrying out these indirect tests it was found particularly useful to:

(a) weigh total oxinates and total oxides;
(b) titrate total oxyquinolates and weigh total oxides.

Binary mixtures of pure tungstates, molybdates, and vanadates were tested by these methods. These were precipitated together as oxinates and weighed. The oxinates were decomposed in the ammonia current and converted into oxides at 480°C. and again weighed. From solution of the oxides in 2 N NaOH the oxinates were re-precipitated as described above and bromometrically determined. Agreement of the found with calculated figures indicates the usefulness of these indirect methods. Equally good results could be obtained with the W-V system.

Vanadium in the presence of molybdenum and tungsten: The total oxinate was precipitated and weighed. $V_2O_3(oxin)_4$ could now be completely leached out from the precipitate with 2-N HCl, for which purpose the oxinates were washed in small portions with 2-N HCl, and finally with a little water until the black colour disappeared. The $V_2O_3(oxin)_4$ was bromometrically titrated. Analysis of the residue from $MoO_2(oxin)_2$ and $WO_2(oxin)_2$ could also be done by the indirect method, giving, by bromometric titration of the phosphoric solution of residue, a total value which could be at once determined.

Theory Proved

Molybdenum in the presence of tungsten: From a neutral or quite weak alkaline solution of alkali molybdate and tungstate the molybdate could be quantitatively precipitated with oxyquinoline, while the tungstate remained in solution. Some oxine was again added to the filtrate which was then acidulated with 2-N acetic acid and heated to b.p., whereby $WO_2(oxin)_2$ was quantitatively precipitated. Results show. Agreement between found and theoretical is again very close.

Tungsten in the presence of iron. If iron (III)-ion is kept in solution in a weakly alkaline tungstate solution by addition of 4 g Seignette salt (Rochelle salt = NaK tartrate) the iron could be quantitatively precipitated therefrom with oxyquinolin, but the tartrate present in soluion prevents complete precipitation of $WO_2(oxin)_2$ when the

solution is acidulated with acetic acid; so that, in order to precipitate also the tungstate from the filtrate the tartrate must be replaced by a milder complex-forming agent. Addition of glycerine was found satisfactory.

The Glycerin Method

To a solution of iron (III) chloride and alkali tungstate in 0.01-m phosphoric acid was added 0.5-2 c.c. glycerin, and made weakly alkali by addition of some soda lye. By this means there should be no brown discoloration of iron (III) salt. The $Fe(oxin)_3$ was precipitated in the cold with a 50-100 per cent excess of alcoholic oxine solution, and heated for fifteen minutes to cake the precipitate. After filtration the iron oxinate was gravimetrically or electrometrically determined in the usual way with bromate.

To the alkaline filtrate of the iron precipitate further oxine was added and the mixture weakly acidulated at b.p. with 2-N acetic acid, whereby all the tungsten as oxinate was precipitated and determined as previously described. With a too large excess of glycerin the results for iron are too low. The iron oxinate remaining in solution separates out with the yellow oxine of tungstic acid only after acidulation and causes dark discoloration. This part of the iron oxinate may be easily removed by extraction with cold 2-N HCl and washing with a little water; and it may be readily seen when the last traces of the dark-coloured iron oxinate have been removed, and the tungstic oxinate appears of pure yellow colour.

The Hydrochloric Acid Method

From the mixture of precipitated and weighed oxinates $Fe(oxin)_3$ and $WO_2(oxin)_2$ the former may be readily dissolved out with cold 2-N HCl. At higher temperataure, however, the tungstic oxinate is strongly attacked by the acid. Cold 1-N HCl dissolves the iron oxinate too slowly. HCl separation can therefore only be used under strictly limited conditions. Separation of iron from Mo may be done by precipitating the oxinate and dissolving out the iron oxinate with cold 2-N HCl in like manner as with the tungstate. Since oxinates of N″ CO″ MN″ and CR‴ in 2-N HCl are much more readily soluble than iron oxinate the HCl method may also be used for separating these metal ions from molybdic and tungstic acids.

This proceeds in similar manner as the tungstate by the glycerin method. Some results of tungstate, molybdate, and vanadate determinations in the presence of iron (III) are given in Table 8, from which it may be seen that useful results can be obtained if definite concentration limits are strictly observed.

Alloy Mixtures by Powder Metallurgy

Chrysler Corporation, Detroit, announces many new metal alloy mixtures achieved by processing more than 28 different kinds of metals into bearings, machine parts, and other items by powder metallurgy. These new alloys are all members of the "Oilite" family which began with the first heavy duty self-lubricating bronze bearing. The Corporation has two laboratories engaged constantly in the research and development of powder metallurgy.

The use of metal powders is not limited to one kind or one class of metals. One of the advantages possessed by the powdered metal technique is that machine parts of intricate design and other articles can often be made to size and shape without subsequent machining. Broad ranges of design, size and weight are accommodated. Typical of new alloys is the development of both anti-friction and friction materials. However, this process is not limited to metals alone. Many practical applications for the new alloys have been found in the aviation, metal working, machine tool, chemical, textile, and forest products industries.

Recovery of Vanadium from Slag

Wartime shortage of vanadium as an alloy for steel led the Germans to devise methods for recovering this metal from the slag from Bessemer converters, according to a report of the Office of Technical Services, Department of Commerce, Washington 25, D.C.

Though expensive, the German recovery methods might help to augment vanadium supply, since they could be used in processing iron ores containing vanadium. Domestic and Swedish iron ores used by the Germans contain about 0.1 per cent vanadium. When iron from these ores is converted to steel, the vanadium goes into the converter slag in a concentration of 1 per cent or more. If the slag is remelted and the metal again passed through the converter, the vanadium may be concentrated in the slag to the extent of 10 per cent, enough to leach out by the sodium process. In this way, the Germans obtained an estimated 6,500,000 lb. of vanadium a year. It was needed for high-speed tool steel and used as a substitute for other scarce alloying metals, such as molybdenum.

Tin Production Reviewed

A Survey of Sources and Methods

ASIA before the war supplied the largest share of tin for the world market, south-eastern Asia producing 68 per cent of the world total. The deposits there are especially well situated for profitable working. In addition, there is the cheap labour of Chinese coolies and good shipping facilities.

With the over-running of the tin-producing countries by Japan, however, control over tin production passed out of the hands of the United Nations and the tin monopoly broke down, as is shown in the following survey. But new sources, as well as tin conservation and tin regeneration from old cans and other scrap helped the Allies to overcome difficulties.

Burma's tin-ore mining was badly developed in the past. The metal was produced only as a by-product of wolfram. The tin mined amounted to only 4500 tons or 2.6 per cent of the world production. The best ore deposits lie in the Karemi district; the others on the south-eastern coast-line near Tavoy and Mergui. The concentrates obtained from the ores are worked up exclusively in the smelting works of the Straits Settlements.

The principal tin deposits in Siam are on the western borders of the country along the four vast granite chains which cross the Malacca Peninsula from north to south. Nearly three-quarters of the total tin production of the country comes from the district along the western Manur and the "tin" island, Puket (Poncka). The annual production amounted to 14,200 tons or 8.1 per cent of the world production. Before the war all the leading tin companies were controlled by the London Tin Corporation.

Malayan Deposits

The British Malay States at the southernmost part of the Malay Peninsula contain tin deposits, which are a continuation of the Siam deposits, on the west side of the peninsula, adjacent to the central Cordillera. Considering the good transport facilities and the ample water supplies of this district, the tin industry could be developed more favourably. The largest mines, in order of their output and importance, are found in the States of Perak, Selangor, Pahang, and Negri Sembilan. With an annual average of 57,800 tons, or about 33 per cent of the world production, British Malaya took first place among the tin exporting countries of the world. The Malayan Government was able to balance its budget by means of this revenue. Owing to heavy exploitation of some deposits it is feared that they may be exhausted soon. But then it may be possible to exploit the abundant primary deposits. Judging the future by the past, it may be assumed that Malay will regain her prominent position in tin production.

The smelting of the metal in British Malaya was as important to England as the tin-ore production. There are now two modern smelting plants in Singapore and Penang besides a small Chinese melting plant. The working conditions for tin smelting are peculiar; after concentration of the ores at the mines, because transport costs are insignificant in proportion to the tin's value, the smelting of the ores is not necessarily done locally. In the smelting works of British Malaya, beside the concentrates of the indigenous ores, those from Siam, Burma, Indo-China, and other parts of East Asia and even from South Africa were smelted. The importance of these Malayan smelting works becomes more obvious if one considers that nearly 50 per cent of the total tin ores of the world are dealt with here.

"Tin Island"

To the south-east, Malaya adjoins the Dutch East Indies Colonies, with the islands of Sumatra, Borneo, Java, and others. Here are found the southerly spurs of the tin ore-containing rocks of the Malacca Peninsula, in the south-eastern parts of Sumatra and on the islands of Singkep, Bangka, and Billiton. Smaller deposits, which are exploited by the natives, are also found in the eastern part of Sumatra. The mining is from alluvial or underground sources. In this part of Asia, tin mining is concentrated within a small area. Altun, the smallest Bangka island, known since 1710 as "tin island," has supplied up to now more than half the total Dutch yield. The Bangka tin is produced on the spot from the ore, while the concentrate of the other Netherland's deposits was shipped to Arnhem. New mines in the islands of Karimoen and Koendoer have not so far been exploited.

To the east of Burma, in the southern part of China, are some tin districts where the working of mines is quite different from that of the Malacca Peninsula. They are worked on a very small scale by Chinese owners. The tin ore is mined under unfavourable conditions from primary deposits. The ore has to be hauled from a great depth and scarcity of water hinders production. About 85 per cent of the Chinese tin production comes from the south-western province of Yunnan. The deposits there are in Kochiu and are not far from the corner where Burma, China, and Indo-China join. There was a temporary check in Chinese tin production before

the war. But this was overcome at the outbreak of the war, and the Chungking Government has since paid special attention to it as an important source of revenue and means of barter. The ores of the Kochiu mines are now smelted and refined on the spot Chinese production was in former years about 11,000 tons or about 6.4 per cent of world production.

In the east of Siam, south of the Chinese province of Yunnan, lies French Indo-China. The tin deposits of this district can be considered as a continuation of the Chinese deposits in Yunnan. Compared with production in other parts of the world, they are of little importance, because the annual production amounts to only 1500 tons. The output is mainly from the district of Nam-Patène, near Mikong. It yields about two-thirds of the country's total output. Most of the mine work is manual.

Ore mining in Asia is carried on by varied methods. In the numerous small works belonging to the Chinese, the work goes on as it did centuries ago by a floating process. The floated tin ore and mud is afterwards washed in simple shallow wood basins. The mining is generally very primitive and requires little capital. The cheap labour and hand working allows a small profit. Quite different are conditions in the larger works run by Europeans. These companies, with sufficient invested capital, are working the mines mechanically by modern methods. Furthermore, these companies combined financially and often pooled their technical resources.

The London market always played a great part in the development of Asiatic tin production and soon became the financial centre of it, supported by the commodity exchanges which regulate and organise the market. The London Metal Exchange has long played a leading part in control over tin prices. It also helped to establish an International Tin Agreement, of which the six principal participants were Malaya, Bolivia, Netherlands East Indies, Nigeria, Siam, and the Belgian Congo.

During the war when Japan overran many tin-producing areas, a Combined Tin Committee was set up in Washington to administer the allocation of tin. With the end of the war and the re-acquisition of the tin-areas a conference was held in London recently to study the future world positon of tin. Delegates from Belgium, Bolivia, China, France, the Netherlands, Thailand, the U.S.A., and Great Britain took part. The conference concluded that there is not likely to be an excess supply of tin for some years to come, and made recommendations for continuous inter-governmental review of the position in the future.

Non-Ferrous Metals

Large Deposits in India

ACCORDING to information received from Bombay, vast deposits of almost all the non-ferrous metals, particularly aluminium, magnesium, manganese, chromium, and beryllium, are believed to exist in India. A report to this effect has recently been presented to the Government by the Non-Ferrous Metals Industrial Panel.

Commenting on this report, *Capital*, Indian weekly review, says that special emphasis was laid by the Panel on the development of the aluminium industry. India's reserves of high-grade bauxite are roughly estimated at 250 million tons. The maximum production of virgin aluminium is estimated at 8000 tons. The Panel has set the minimum target for the first five years at 15,000 tons, which could be reached by starting new factories; production of 50,000 tons a year at the end of fifteen years is considered possible. The Panel is said to be opposed to protective duties on imports of virgin aluminium, but urges that imports should be controlled and that exporting countries should be prevented from dumping their aluminium in the Indian market.

The Panel estimates that peak production during the first year of copper and copper-base alloys will be 25,000-30,000 tons; of electrolytic copper, 16,000-20,000 tons; copper and brass sheets, 35,000-40,000 tons; lead, 25,000 tons; zinc, 50,000 tons; tin, 4000 tons; aluminium ingots, 20,000 25,000 tons; aluminium sheets, 10,000-12,000 tons; aluminium foil, 1500-2000 tons; aluminium wire, 5000 tons; aluminium tubes and shapes, 2000 tons; and antimony, 400 tons.

NEXT WEEK'S EVENTS

MONDAY, DECEMBER 9

Institution of the Rubber Industry (Midland Section). James Watt Memorial Institute, Birmingham, 7.15 p.m. Forum: "Electrostatic Hazards in Industry."

Society of Instrument Technology (North-West Section). College of Technology, Manchester, 7.15 p.m. Mr. J. O. C. Vick, Mr. C. Lamond, Mr. W. Lindsay: "Organisation of an Industrial Instrument Department."

TUESDAY, DECEMBER 10

Institute of Physics (Scottish Branch). The University, Glasgow. Professor Oliphant: "Betatrons."

Institution of Structural Engineers (Lancashire and Cheshire Branch). College of Technology, Manchester, 7.15 p.m. Mr. F. R. C. Smith and Mr. G. Forrest: "Aluminium Alloys, Their Properties and Some of Their Applications to Structure."

WEDNESDAY, DECEMBER 11

Royal Society of Arts. John Adam Street, Adelphi, London, 5 p.m. Mr. John Gloag: "Planning Research for Industrial Design."

Society of Chemical Industry (Nutrition Panel). Chemical Society's rooms, Burlington House, Piccadilly, London, W.1, 6.30 p.m. Mr. D. P. Hopkins: "Fertilisers, Manures and Nutrition."

British Association of Chemists (London Section). Gas Industry House, 1, Grosvenor Place, London, S.W.1, 7 p.m. Mr. G. M Rose: "Insurance and the Scientific Worker."

Institution of the Rubber Industry (West of England Section). George Hotel, Trowbridge, 7.45 p.m. Mr. J. R. Shanks: "Non-Brass Bonding."

British Association of Chemists (Birmingham Section). Chamber of Commerce, Birmingham, 7 p.m. Mr. W. E. Ballard: "Metal Spraying by the Wire Process."

Royal Institute of Chemistry (Newcastle-on-Tyne and North-East Coast Section). King's College, Newcastle, 6.30 p.m. Mr. R. Belcher and Dr. C. L. Wilson: "Methods and Apparatus in Inorganic Microchemistry."

THURSDAY, DECEMBER 12

Royal Institute of Chemistry (Liverpool and North-Western Section). Technical College, Widnes, 7 p.m. Dr. G. P. Gibson: "Laboratory Fractionation."

Royal Institution. 21 Albemarle Street, London, W.1, 5.15 p.m. Mrs. Kathleen Lonsdale: "What Chemistry Owes to X-Rays—Part II."

FRIDAY, DECEMBER 13

Society of Chemical Industry (Chemical Engineering Group). Geological Society's Rooms, Burlington House, Piccadilly, London, W.1, 5.30 p.m. Mr. D. Allan: "A Survey of Fat Splitting."

Society of Chemical Industry (South Wales Section). Royal Institution of South Wales, Swansea, 6.30 p.m. Dr. S. C. Townsend and Mr. de W. H. West: "Nickel Refining and Subsidiary Operations."

Oil and Colour Chemists Association (Manchester Section). Engineers' Club, Manchester, 2 p.m. "The Protection of Ships' Bottoms and the Formulation of Anti-corrosive Compositions."

Society of Instrument Technology (Scottish Section). Royal Technical College, Glasgow, 7 p.m. Mr. J. E. O'Breen: "Effect of Design of Boiler Auxiliaries on the Choice and Performance of Automatic Control."

German Technical Reports

Some Recent Publications

SOME of the latest technical reports from the Intelligence Committees in Germany are detailed below. Copies are obtainable from H.M. Stationery Office at the prices stated.

BIOS 762. The manufacture and practical application of German synthetic tanning materials and related substances (10s.).

BIOS 764. Production of aluminium compounds (3s. 6d.).

BIOS 785. German mica industry (5s. 6d.).

BIOS 835. *Amalia, Bochum*: Benzole refinery (6d.).

BIOS 842. *Chemische Werke Albert, Wiesbaden*: Synthetic varnish resins and moulding powders (4s.).

BIOS 843. *I.G. Farben, Hoechst*: Manufacture of ethyl acetate from acetaldehyde (1s.).

BIOS 854. *Deutsche Gold und Silber Scheideanstalt, Rheinfelden*: Sodium peroxide, sodium percarbonate, and sodium phigran (1s. 6d.).

BIOS 855. *I.G., Leverkusen*: Manufacture of salt cake, sodium sulphide, and sulphigdan (1s. 6d.).

FIAT 212. *I.G. Farben, Hoechst*. Quick-freezing of foods in liquid nitrous oxide (1s. 6d.).

FIAT 391. *I.G. Farben A.G., Leverkusen*: New adhesives (1s. 6d.).

Personal Notes

DR. C. J. MACKENZIE, president of the National Research Council of Canada, has been elected a Fellow of the Royal Society.

SIR RICHARD A. PEASE, M.A., has been elected president of the National Benzole Association in succession to the late Sir David Milne-Watson.

DR. W. R. BURNHAM, of West Ham Municipal College, has been appointed head of the Department of Chemistry and Biology at Leeds College of Technology.

PROFESSOR H. C. UREY, Professor of Chemistry in Chicago University, will receive the honorary degree of D.Sc. of Oxford University on December 14.

MR. R. A. HEYWOOD has succeeded Mr. G. H. Tipper as Director of Mica. Mr. Tipper, who has resigned on health grounds, will, however, act as the Board of Trade's consultant on mica.

MR. W. W. PARISH has retired from the chairmanship of Vulcan Foundry, Ltd., but will remain a member of the board. MR. F. S. WHALLEY, managing director, has been appointed chairman.

MR. J. WILLIAMS, formerly manager of the Castner Kellner Works of I.C.I., gave a talk at a meeting of Runcorn Rotary Club last week, describing the development of the chemical industries now centred in Widnes and Runcorn.

MR. G. E. HOLDEN, O.B.E., M.Sc., F.R.I.C., chairman and managing director of the English Velvet and Cord Dyers' Association, Ltd., has been appointed Controller of Dyestuffs in succession to Mr. T. H. Hewlett, who has resigned on health grounds.

DR. F. C. WILLIAMS, D.Sc., has been appointed Edward Stocks Massey Professor of Electro-Technics and director of the Electro-Technical Laboratories at Manchester University, in succession to Professor Willis Jackson. He will take up his new duties at the beginning of the Lent Term.

MR. D. G. RANDALL, B.Sc. (Eng.), A.M.I.Chem.E., has been appointed a technical director in control of the chemical engineering division of Gordon Laycock & Partners, Ltd., Leeds. Previously with the A.P.V. Co., London, Mr. Randall has a wide experience of distillation processes in particular, and of many other branches of chemical engineering.

MR. J. BARRITT, B.Sc., A.R.C.S., A.R.I.C., head of the Department of Chemical Technology at the Wool Industries Research Association, has been appointed honorary secretary of the Society of Dyers and Colourists in succession to the late Mr. J. S. Ridsdale. Mr. Barritt has been an active member of the publications committee and of the technical advisory committee of the Society of Dyers and Colourists for several years and of local committees of the Royal Institute of Chemistry and the Society of Chemical Industry.

U.K. Tin Position

Further Decline in Ore Stocks

A FURTHER decrease in the stocks of tin ore in the U.K. at the end of October is reported by the Ministry of Supply. Stocks totalled 7727 tons, as compared with 8052 tons at the beginning of the month, and 9049 tons at the beginning of September.

Stocks of tin metal held by the Ministry on October 31 were 9022 tons, compared with 8738 tons at the beginning of the month, while stocks held by consumers at the end of the month were calculated at 4274 tons and reported to be 3936 tons. As in September, no arrivals of tin were reported during the month, but production is shown as 2964 tons.

Deliveries of tin to the U.K. consumers during October amounted to 2627 tons and deliveries for export were 53 tons. Consumers' consumption of metal during the month was 2590 tons.

B.S.I. YEARBOOK

The 1946 edition of the Yearbook of the British Standards Institution, which has just been published, gives a subject index and a synopsis of each of the 1,300 British Standards now current. These standards have been prepared by representative committees of 44 different industries. The Yearbook includes lists of members of the General Council of the Divisional Councils and of the Industry Committees of the Institution, as well as other useful information about its work. Copies (2s. each) can be obtained from the Publications Sales Department, British Standards Institution, 28 Victoria Street, London, S.W.1.

Of special interest as their first since before the war, is the catalogue published by Robert Jenkins & Co., Ltd., Rotherham, effectively illustrative of the variety of general engineering work which the firm undertakes. An introduction refers briefly to their note-worthy part in war production.

Home News Items

The price of cadmium was increased in London this week by 1s. 6d. to 10s. per lb., delivered buyers' works.

One million ounces of silver have been brought from the United States to London in the "Queen Elizabeth."

The Directorate of Mica is now at Landsdowne House, Berkeley Square, London, W.1. (Tel.: GROsvenor 4060.)

Glycol diabietate and sebacic acid are exempted from Key Industry Duty until December 31 under the Safeguarding of Industries (Exemption) (No. 5) Order, 1946, (S.R. & O. 1946, No. 1955).

D.T.D. Specification 683, "Aluminium Alloy Bars, Extended Sections and Forgings," has been reprinted to include Amendment List No. 1 and is obtainable from H.M. Stationery Office (1s.).

Carrying 320 tons of linseed oil for distribution among local linoleum manufacturers, a tanker now plies monthly between Thames Haven and Kirkcaldy, but this delivery amounts to only 30 per cent of pre-war consumption.

One of the world's largest glass tanks at the sheet works of Pilkington Brothers, St. Helen's, was lit, with a torch of fibre glass, by the Minister of Works last week. The new tank, which, with ancillary units, including a new warehouse, gas producer and boiler plant, has cost over £500,000 and is expected to supply 1,000,000 ft. of glass weekly, sufficient to glaze 200,000 houses a year.

A variety of information about German manufacturing processes and technical developments has been collected by the British Intelligence Objectives Sub-Committee and Allied teams of experts and, in order to bring this to the attention of British concerns, the Board of Trade has aranged a small exhibition, to be held in the cinema at I.C. House, Millbank, London, S.W.1. from December 10 to 19 (10 a.m.-5 p.m.: Saturdays, 10 a.m.-1 p.m.) Later the exhibition will be staged at Cardiff, Birmingham, Manchester, Leeds, Nottingham, Newcastle, Glasgow, Belfast and Bristol.

Lactic acid prices have been increased by Bowmans (Warrington), Ltd., as follows: dark, 44 per cent weight, to £55 per ton; pale, 44 per cent weight, to £65 per ton, ex works, in returnable barrels. The changes are stated to be due to increases in the prices of raw materials.

The Customs and Excise Department has issued Notice No. 78B (Drugs and Medicines), which supersedes the June, 1943, edition, and gives detailed information as to the charge of purchase tax on drugs and medicines under the Finance (No. 2) Act, 1940, as modified and amended by subsequent exemption orders.

Extraction of aluminium from the spoil heaps of the district might create a great new industry, declared Sir Herbert Wragg, speaking at Swadlincote, Derbyshire. He referred to local supplies of the "best fireclay in the world," and said that, with atomic energy, the cost of production of aluminium from clay would be greatly reduced. With its oxide content, aluminium could be produced from the spoil heaps.

The selling price of molasses for all purposes other than cattle feed will be increased as from January 1 next to cover the current average cost of supplies, according to a Board of Trade announcement. This will involve a considerable increase in the production costs of industrial alcohol and solvents derived therefrom and a new Order will accordingly be issued in the near future revising the existing maximum selling prices prescribed for these commodities.

A North-Eastern Group of the Industrial Applications Section of the Royal Statistical Society has now been formed. It is centred on the Tyne and Wear areas and includes a Tees-side sub-group. Mr. J. Elliott, of Lemington Glass Works, Lemington-on-Tyne, is honorary secretary of the new group, while Mr. J. T. Richardson, of the Research Department, I.C.I. Ltd., Billingham, is honorary secretary of the sub-group. Further information is obtainable from the Assistant Secretary, Royal Statistical Society, 4, Portugal Street, London, W.C.2.

The increasing importance in industrial chemicals and other industries, of the determination of the *p*H of a solution or emulsion as a measure of acidity or alkalinity, makes especially interesting the *p*H meter. Type D-303-B, made by Muirhead and Co., Ltd., Beckenham, Kent. This instrument, which the firm believe to be the only direct-reading *p*H meter available in this country, is described in Bulletin B-569-B, just to hand, showing how *p*H is indicated directly on a 6 in. meter and, apart from initial setting up adjustments, is as readily readable as the ordinary voltmeter.

Overseas News Items

A nuclear research laboratory is to be established at Melbourne University, the Australian Prime Minister has announced.

Alkyd resin production for coatings is affected in the U.S.A. by shortage of castor oil, linseed oil, soya bean oil, glycerine, phtalic anhydride, formaldehyde and butanol.

An iron and steel industry is to be started in Leningrad, it is reported, following the discovery of iron ore deposits near the Finnish border.

Production of soap substitutes in the United States will be increased by 160,000 tons a year—three times the 1945 level—states a Washington report.

A uranium mine has been discovered in the foothills of the Andes, in the Argentine province of Mendoza, according to an official announcement by the Mendoza Provincial Government.

Non-ferrous metal stocks held by the U.S. War Assets Administration, including copper, lead, tin and spelter, are to be offered for sale on a competitive basis, states a Washington report.

The synthetic production of saccharin from anthranilic acid is described in a report translated from the German (PB901), the saccharin yield being placed at 58-60 per cent and the costs no higher than in the Fahlberg process.

A quarter of Japan's former 1,500,000-ton annual production of prosphates came from the Island of Angaur in the Palau archipelago, to which the Allied authorities have authorised the Japanese now to return in order to mine phosphate rock. Production is expected to equal pre-war levels.

Australia imported drugs and chemicals to the value of £2,807,000 sterling from the U.K. during the trade year 1945-46, as compared with £2,498,000 the previous year. Her exports of drugs and chemicals to the U.K. during 1945-46 were valued at £A124,000, as compared with £A72,000 the previous year.

Supplies of natural rubber available for manufacturing countries in 1947 may total 1,200,000 tons, as against 860,000 tons this year, according to a report by the Four-Nations Rubber Study Group, composed of representatives of Britain, France, Holland and the United States. Further increases are expected by 1948, with an ultimate potential production of some 2,000,000 tons per annum.

Price of the synthetic rubber type GRS (buna-S) and of butyl has been reduced from 20.35 cents to 18.5 cents a pound at the Government-owned plant of Polymer Corporation, at Sarnia, Ontario. This is the seventh price reduction effected by the Polymer plant.

Europe's richest uranium deposits are in Poland, according to Professor Bohdanowicz, director of the Polish Geological Institute. The deposits are in Lower Silesia and were exploited by the Germans during the war. Parts of the mines were damaged, and repair work is now going on, although no actual mining of the ore is taking place.

New lignite deposits have been found in Austria, near Klagenfurth, Carinthia, which are estimated by experts to contain 500,000 tons of lignite. They are presumably connected with the deposits in Sittenberg, which are of great importance for the magnesite industry of the country.

Possibly greater than that of any other iron works in the world, the annual production capacity of electro pig iron at the large state-owned works in Northern Sweden, Norrbottens Jernverk, has been increased to 100,000 tons since September, when a third electro-iron furnace was put into operation.

A geochemical prospecting unit for ores has been set up in Washington to investigate the geochemical dispersal of ore metals in soils, plants and natural waters in the vicinity of oxidising ore deposits, for the purpose of developing new techniques of prospecting for metals in areas where the deposits are not exposed at the surface.

An acute shortage of saccharin is reported from America, owing to a four-and-a-half months' strike at the plant of the leading manufacturer; keen demand caused by general sugar shortage; and the price ceiling on the product, rendering new production impossible. Dulcine, peryllartine and other sweetening agents have likewise virtually disappeared from the market.

Indicating the rapid development of the Commonwealth's organic chemical industry, a plant which, states the *Industrial Australian and Mining Standard*, will "make Australia self-sufficient in sulphadiazine supplies," has been completed by Monsanto (Aust.) Pty., Ltd. Costing £A20,000, the plant is expected to meet the full Australian requirements of all sulpha drugs.

A mineral information bureau is to be established shortly in Calcutta under the Indian Department of Works, Mines and Power. Its main functions will be the dissemination in non-technical language of facts, relating to Indian minerals, fuels, iron ore and ferro-alloy minerals, light and base metal minerals, precious metals, gems, minerals for chemical industries, industrial clays, sands and miscellaneous minerals. Advice will also be obtainable on the use and processing of raw minerals and quantitative data on the availability and suitability of minerals for industries; and, to assist industrialists, laboratory tests will be carried out and technologists recommended for mine survey, geological survey, prospecting and opening up of economic deposits.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

ARLEE, LTD., Ashtead, chemical manufacturers. (M., 7/12/46.) November 11, charge, to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; charged on Green Roof, Ashtead Station. *£650. January 15, 1945.

SOZOL (1924) LTD., London, E.C., manufacturers of chemical preparations. (M., 7/12/46.) November 8, £800 mortgage, to Barkerend Mills Co., Ltd.; charged on certain land at Browning Street, Bradford. *Nil. December 4, 1945.

SURREY COPPER CO., LTD., Surbiton. (M., 7/12/46.) November 5, £1000 debenture, to J. G. Bain, Surbiton; general charge. *Nil. December 11, 1945.

Company News

The name of **Renson & Brod (Near East) Ltd.** (375,343), 36, Sackville Street, W.1, has been changed to **Renson & Brod (Chemicals) Ltd.**

Profit earned by **Birmid Industries, Ltd.**, during the year ended October 31 was £128,218, as compared with £124,979 the previous year. The dividend and cash bonus both remain at 10 per cent.

Hardman and Holden, Ltd., Manox House, Miles Platting, Manchester 10, is taking over, as from January 1 next, the business previously carried on by its subsidiary company, Manchester Oxide Co., Ltd. To achieve the change, which is merely formal, the latter company will go into a Members' Voluntary Liquidation.

New Companies Registered

Chemical Plant & Equipment Co., Ltd. (424,091).—Private company. Capital £1000 in £1 shares. Chemical technical engineers, metallurgists, etc. Directors: C. Schmeidler; A. Neil; F. Harman. Registered office: 49, London Wall, London, E.C.2.

Forth Products, Ltd., (24,752).—Private company. Capital £1000 in £1 shares. Bleach manufacturers, chemical merchants, etc. Directors: J. S. McKee; Jack McKee; Mrs. M. McKee. Registered office: Burnside, Auchtermuchty, Fife.

North-West Chemical Industries, Ltd. (424,481).—Private company. Capital £100 in £1 shares. Manufacturers of and dealers in chemicals, gases, drugs, disinfectants, fertilisers, etc. Subscribers: A. Weil. 36, Grove House, Waverley Grove, London, N.3; R. Davis.

Drummond Davis & Co., Ltd. (422.182).—Private company. Capital £100 in £1 shares. Manufacturers, importers and exporters of and dealers in chemicals, drugs, etc. Directors: H. Walker; P. Reoch: A. Taylor. Registered office: 7, Arundel Street, Strand, London, W.C.2.

Chemical and Allied Stocks and Shares

THERE has been well sustained demand for industrial shares with prices showing further gains on balance. British Funds strengthened, but home rails, although firmer, became less active after a rally which improved some stocks to around their "take-over" levels. The better tendency in rails reflected recognition of the dividends due before January 1, 1948, the date fixed by the Government for nationalisation.

Chemical and kindred shares reflected the strength of industrials, Imperial Chemical rising further from 43s. 10½d. to 44s. 4½d., while on higher dividend hopes Turner & Newall were good at 90s. and Lever & Unilever moved up to 53s. 9d. on further consideration of the annual meeting. Fisons were dealt in up to 61s., B. Laporte at slightly over 100s. and British Drug Houses were 58s. Morgan Crucible "A" ordinary showed strength at 57s., Stevenson & Howell were 31s. 6d., Greeff-Chemicals Holdings 5s. ordinary 13s., and Major & Co.'s 2s. ordinary were quoted at 5s. The

units of the Distillers Co. have been firm at 139s. 6d. on the possibility of an increase in the interim dividend. United Molasses eased to 54s. 9d. Borax Consolidated displayed firmness at 48s. 3d., and Nairn & Greenwich improved to 83s. 1½d. on higher dividend hopes. There was a better trend in paint shares. Lewis Berger rising further to £7¾ pending the dividend, and Pinchin Johnson were 47s. 6d., but Goodlass Wall eased to 29s. 3d. General Refractories rose to 22s., Dunlop Rubber were 73s. 4½d., and British Oxygen 101s. 10½d. British Aluminium strengthened to 45s. 7½d., and British Glues & Chemicals 4s. ordinary showed firmness at 17s. 3d.

Iron and steels attracted in view of the good yields and the general assumption that the industry has a two-year " reprieve " from nationalisation. Stewarts & Lloyds were 54s. 3d., Tube Investments further strengthened to 130s. 7½d., Babcock & Wilcox were 69s. 6d., Guest Keen 45s. 7½d., Hadfields 26s. 3d., John Summers 31s., United Steel 25s. 10½d., and T. W. Ward 50s. 3d. Shares of coal distributors were wanted, Wm. Cory rising to 106s., and Lambert Bros. to 86s. 3d., while among collieries Powell Duffryn firmed up to 26s. 1½d. and elsewhere Staveley were 65s. and Shipley 45s. 3d. In other directions, Imperial Smelting further improved to 21s. 6d., butt Amalgamated Metal eased tto 20s. 1½d. on renewed doubts whether an early reopening of the London Metal Exchange is likely. British Match rose further to 52s. International Combustion shares rose to £9¾ accompanied by higher dividend hopes and renewed talk of a share-splitting scheme. Triplex Glass shares rallied to 37s. 9d., the promise of increased steel for motor car manufacturers connoting higher production for the latter and bigger demand in future for safety glass. Textiles eased on the Cotton Bill, although Fine Spinners strengthened to 27s. in view of the debenture redemption announcement. Bdadford Dyers were 23s. 10½d., Calico Printers 24s. and Bleachers 13s. 6d. Electrical equipments have been favoured, Cromptons firming up to 34s. 6d. on the results, while General Electric were 103s. 9d. Associated Electrical 73s. 6d., and English Electric 65s. 9d.

Boots Drug were 63s. 9d., Beechams deferred 28s., Sangers 33s. 9d., and Griffiths Hughes 63s.xd. De La Rue were £13 9/16xd, British Industrial Plastics 2s. ordinary 7s. 6d., and Erinoid 15s., with British Xylonite quoted at £6½. Tarmac rose further to 76s. Leading oil shares were slightly higher on balance, with Shell 94s. 4½d., and Burmah 68s. 9d., while V.O.C. were firm at 77s. 6d.xd. on the bigger interim, and C. C. Wakefield rose further to 76s. Apex (Trinidad) were 37s. on higher dividend hopes, while Mexican Eagle have been in demand up to 15s. 9d.

British Chemical Prices

Market Reports

A CONTINUED steady demand for practically all industrial chemicals is reported on the London general chemicals market, while the volume of export business during the past week has been well maintained. A strong price position is in evidence throughout the market. A strong price position is in evidence throughout the market. The soda products are moving along routine lines and there has been no quotable change in the position of chlorate of soda, supplies of which are insufficient to meet current requirements. Among the potash chemicals, makers of permanganate of potash are well booked and supplies of the pharmaceutical and technical qualities are being steadily disposed of. In other directions glycerine is a brisk market and white powdered arsenic and formaldehyde continue in good call. The lead oxides are firm. There has been a steady pressure for deliveries in the coal tar products market, with pitch in steady demand for both home and export account. Naphthalene offers are scarce, while a fair demand is maintained for cresylic acid.

MANCHESTER.—A steady flow of inquiries has been reported on the Manchester chemical market during the past week. Home industrial users have continued prominent with offers of replacement business, the shippers have been fairly well represented, and both light and heavy products have been the subject of fresh inquiries. Among the heavy chemicals, there is a brisk demand for caustic soda and other soda compounds, while bleaching powder, alum, ammonia and magnesia products, and the mineral acids have also come in for attention. With only a few exceptions supplies of the tar products are moving steadily to the consuming end and in a few instances, notably carbolic acid crystals, benzole and creosote, the demand is in excess of supply.

GLASGOW.—Busy conditions were experienced again in the Scottish heavy chemical market during the past week. Home trade business for spot and forward delivery was on the usual lines, with strong demands for formaldehyde, alkalies, acids, minerals, paint trade raw materials, etc. Export orders and inquiries were again on a considerable scale, but manufacturers are having great difficulty in meeting the demand for prompt delivery. Considerable business was secured for such materials as copper sulphate, sulphuric acid, hydrofluoric acid, limestone, magnesium sulphate, caustic soda, sulphate of alumina, textile chemicals and bleaching powder. Prices are firm in all sections and deliveries are now being quoted very far ahead for most materials.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Ammoniation of superphosphate.—W. Siegal. 32635.

Chlorites.—Solvay & Cie. 32538.

Bleaching alginic acid.—E. Sundye. 32662.

Pesticidal compositions.—W. Thomas, and M. Thomas. 32217.

Polyamide solutions.—Tootal Broadhurst Lee & Co., Ltd., R. P. Foulds, and W. H. Roscoe. 32432.

Olefinic compounds.—United States Rubber Co. 32220.

Resinous compositions.—Westinghouse Electric International Co. 32684.

Aldehydes.—A. Abbey. (Dow Chemical Co.) 33028.

Aluminum-magnesium alloys.—Acme Aluminum Alloys, Inc. 33530-1.

Treatment of coal tar.—W. G. Adam, 32791.

Surface coatings.—Albright & Wilson, Ltd. 33384.

Organic materials.—J. J. Allen, and J. A. Hawkes. 32977.

Stainless steel.—Alloy Research Corporation. 33094.

Glutanic acid.—American Cyanamid Co. 32805.

Polymers.—J. C. Arnold. (Standard Oil Development Co.) 32886.

Isobutylene recovery.—J. C. Arnold. (Standard Oil Development Co.) 33312.

Synthetic resins.—N. M. Beyts, J. M. J. de M. Estevez, W. R. Davies, and I.C.I., Ltd. 33100.

Aluminium alloys.—T. F. Bradbury. 33363.

Treatment of viscose products.—British Celanese, Ltd. 32978.

Polymerisation.—British Celanese, Ltd. 33464.

Crystal formation.—Brush Development Co. 33118-9.

Heat treatment of steels.—B.S.A. Tools, Ltd., and K. J. B. Wolfe. 32910-1.

Drying oils.—H. W. Chatfield. 33330.

Pyrimidine compounds.—Ciba, Ltd. 32828-9.

Condensation products.—Ciba, Ltd 33442.

Condensation products.—Ciba, Ltd. 33443.

Distillation processes.—Commercial Solvents (Great Britain), Ltd., A. J. Caveney, and H. N. Darlington. 33114.

Copper sulphate.—N. Corsini 33263-4.

Phosphatic compounds.—Directie van de Staatsmijnen 32788.

Sulphuryl chloride.—E.I. Du Pont de Nemours & Co. 33321.

Water dispersable compositions.—E.I. Du Pont de Nemours & Co., and C. A. Littler. 32943.

Heat treatment of metals.—K. J. Forrest, W. O. Alexander, and I.C.I., Ltd. 32810.

Polyazo dyestuffs.—J. R. Geigy, A.G. 33219.

Radiophonic circuit condensers. — G. Geloso. 33133.

Polymers.—General Aniline & Film Corporation. 32877.

Green pigments.—General Aniline & Film Corporation. 32878.

Dyestuffs.—General Aniline & Film Corporation. 33149-50-52.

Nitriding steel.—Jack & Heintz Precision Industries, Inc. 33095.

Hydrocarbons.—S. H. Lunt, and N. Drey. 32773.

Ethylene halogenides.—Manufactures de Produits Chimiques du Nord Etablissements Kuhlmann. 32899.

Biguanide compounds.—May & Baker, Ltd., and W. Sabel. 33017.

Alloy steels.—Mond Nickel Co., Ltd. (International Nickel Co., Inc.) 33479.

Electrodeposition of metals.—Monochrome, Ltd., and H. C. Hall. 32774.

Treatment of textiles.—Monsanto Chemical Co. 33120-1.

Sizing textile yarns.—Monsanto Chemical Co. 33232.

Textile finishing.—Monsanto Chemical Co., 33412.

Treatment of fabrics.—Monsanto Chemical Co. 33413.

Zirconium hydrides.—E. P. Newton. (Metal Hydrides, Inc.) 32883.

Reduction of iron ore to metal.—R. Nissim. 32921.

Fertilisers.—Osmotas, Ltd., and T. L. Harborne. 33451.

Fertilisers.—R. Parmella, R. G. Franklin, and I.C.I., Ltd. 33233.

Benzotetronic acid derivatives.—Spojené Farmaceutické Závody, Narodni Podnik. 33022-3.

Complete Specifications Open to Public Inspection

Process for pasting hologen-containing polymerisation products on surfaces.—N.V. de Bataafsche Petroleum Maatschappij. May 2, 1945. 5512/46.

Process for polymerising polymerisable substances in the form of an emulsion.—N.V. de Bataafsche Petroleum Maatschappij. May 2, 1945. 8921/46.

Process and apparatus for transporting assimilable active substances from a reservoir to an assimilating chamber.—C. A.

Reymond, C. Pulejo, and A. Regamey. May 2, 1945. 6965/46.

Production from acetylene of aromatic hydrocarbons and of saturated and unsaturated hydrocarbons.—Synben A.G. Nov. 19, 1940. 14874/41.

Producing silicon and electrical translating elements made therefrom.—Western Electric Co., Inc. July 20, 44. 29998/45.

Modified buna-S resins.—Wingfoot Corporation. May 1, 1945. 21516/45.

Recovery of volatile solvents.—Wingfoot Corporation. April 30, 1945. 21933045.

Urea-formaldehyde condensation products.—Borden Co. May 12, 1945. 14177/46.

Production of araliphatic amines.—J. R. Geigy, A.G. May 8, 1945. 15984/46, and 15699/46.

Continuous process for the manufacture of synthetic resins.—Girdler Corporation. Sept. 13, 1943. 18617/44.

Vinyl halides and process of preparing same.—B. F. Goodrich Co. Nov. 9, 1944. 30254/46.

Unsaturated monomeric organic material and method of polymerising same.—B. F. Goodrich Co. May 3, 1944. 30255/46.

Strong homogenous, coherent coatings and method of forming same.—B. F. Goodrich Co. Nov. 30, 1943. 30256/46.

Synthetic resin latices.—B. F. Goodrich C. Dec. 24, 1942. 30?84/46.

Making a film of thermoplastic material. —B. F. Goodrich Co. Dec. 3, 1943. 30385/46.

Polymerisation.—Pittsburgh Plate Glass Co. April 1, 1942. 7841/44.

Antibiotic substances.—E. R. Squibb & Sons. May 9, 1945. 13426/46.

Complete Specifications Accepted

Copper-chromium alloys.—W. O. Alexander, and I.C.I., Ltd. Jan. 17, 1945.582,236.

Liquid measuring or metering devices.—Aluminium Plant & Vessel Co., Ltd., and C. Hunnikin. March 6, 1945. 582,155.

Processing of dehydrated foodstuffs.—Auto-ordnance Corporation. March 10, 1942. 582,242.

Casting metals.—R. W. Bailey, H. H. Burton, A. B. Winder, Metropolitan-Vickers Electrical Co., Ltd., and English Steel Corporation, Ltd. April 24, 1940. 582,163.

Laminated products.—Bleachers' Association, Ltd., W. Kershaw, and C. J. Whitelegg. July 4, 1944. 582,233.

Production of polystayrene.—A. Boake, Roberts & Co., Ltd., and B. T. D. Sully. March 30, 1942. 582,134.

Systems for producing regulated liquid pressure —W. C. Clothier, B. Naylor, and J. E. P. Dunning. July 7, 1941. 582,084.

Moulding of optical elements from synthetic resins.—C. H. Crooks, W. A. Greenwood, D. Starkie, H. Silber, and I.C.I., Ltd. Feb. 4, 1944. 582,248.

Process for the production of purified magnesium carbonate.—Basic Refractories, Inc. Oct. 7, 1943. 582,023.

Separation of phenols.—H. A. Basterfield, and I.C.I., Ltd. June 19, 1944. 582,057.

Manufacture of polymeric substances containing fatty oil acid radicals.—L. Berger & Sons, Ltd., D. H. Hewitt, and F. Armitage. March 25, 1943. 581,897.

Treatment of fibres, filaments, threads, yarns, fabrics, and like materials having a basis of an organic ester of cellulose.—British Celanese, Ltd. April 30, 1943. 581,947.

Production of copper alloys.—British Non-Ferrous Metals Research Association, G. L. Bailey, and A. P. C. Hallowes. May 21, 1943. 581,903.

Manufacture of organic pigments and moulding powders.—Calico Printers' Association, Ltd., L. A. Lantz, and A. Schofield. May 13, 1944. 582,019.

Process of manufacture of beryllium and its alloys.—Cie. de Produits Chimiques et Electrometallurgiques Alais, Froges et Camargue. Dec. 19, 1940. 582,040.

Manufacture of co-polymerisation products.—Distillers Co., Ltd., J. J. P. Staudinger, and C. A. Brighton. Dec. 9, 1943. 581,995.

Protection of metal surfaces.—E.I. Du Pont de Nemours & Co. June 15, 1943. 582,026.

Therapeutically active hydrazo-compounds containing arsenic radicals and process for preparing same.—E. A. H. Friedheim. Oct. 31, 1942. 582,043.

Manufacture of para-aminobenzene sulphonacylamides.—J. R. Geigy A.G. Feb 17, 1943. (Addition to 560,661.) 581,932.

Manufacture of para-aminobenzene sulphonacylamides.—J. R. Geigy A.G. March 10, 1943. (Addition to 560,661.) 581,934.

Polymerisation products.—I.C.I., Ltd. April 10, 1942. 581,899.

Manufacture of carboxylic acids.—I.C.I., Ltd. April 10, 1942. 581,900.

Manufacture of chlorinated olefines.—I.C.I., Ltd. April 10, 1942. 581,901.

Polymerisation of methyl methacrylate in the presence of aliphatic thiols.—I.C.I., Ltd. March 20, 1943. 582,010.

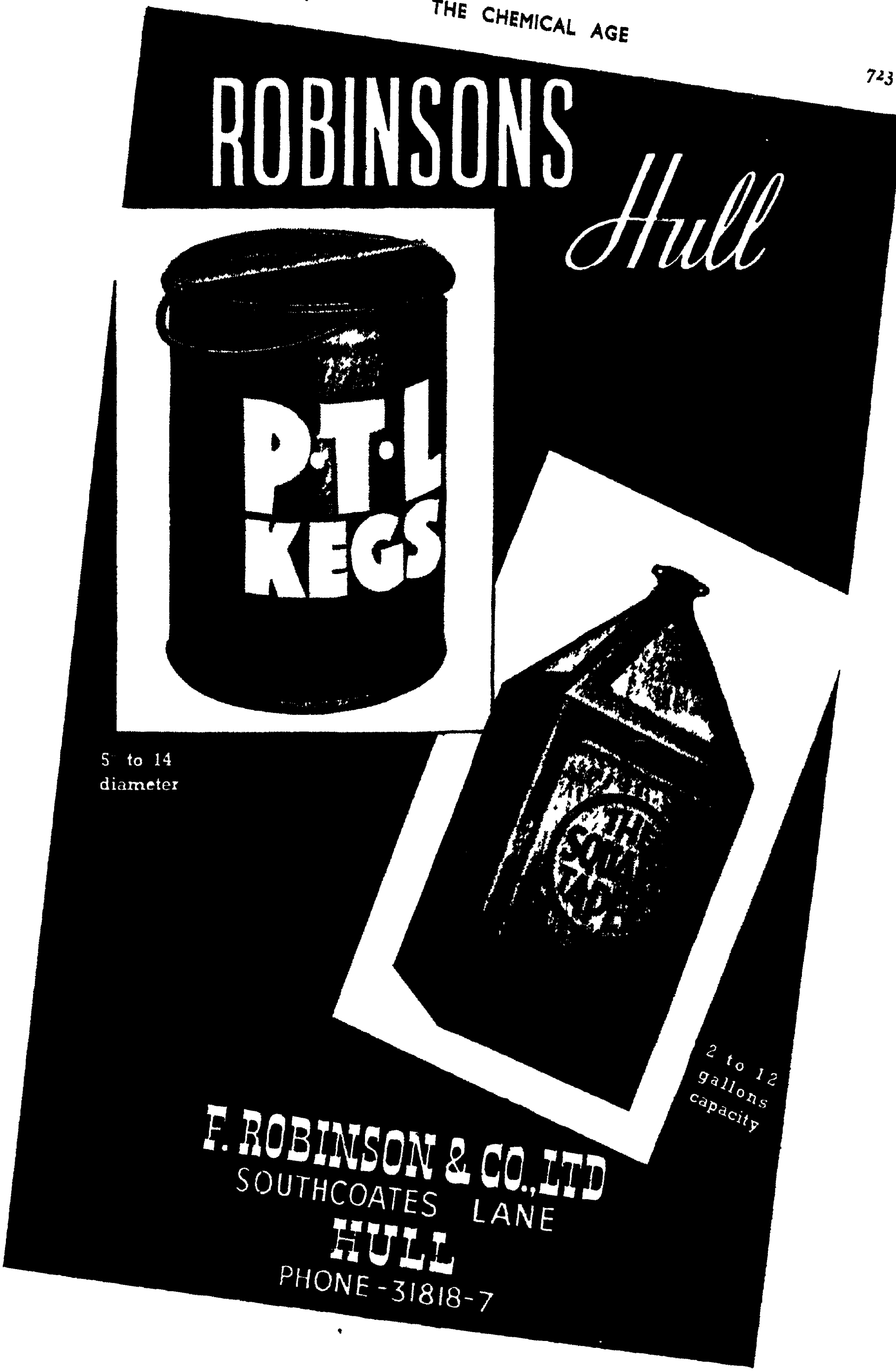
Production of pest-control agents.—H. R. Jameson, and I.C.I., Ltd. Sept. 13, 1943. 582,042.

Polyvinyl alcohol filaments.—Johnson & Johnson (Great Britain), Ltd. April 10, 1943. 582,013.

Production of lithium hypochlorite.—Mathieson Alkali Works. March 19, 1943. 581,944.

Manufacture of lithium hypochlorite.—Mathieson Alkali Works. March 19, 1943. 581,945.

Hypochlorite composition.—Mathieson Alkali Works. Feb. 8, 1943. 581,948.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Method of preparing lithium hypochlorite.—Mathieson Alkali Works. Feb. 8, 1943. 581,949.

Method of improving the physical properties of lead.—Okonite-Callender Cable Co., Inc. March 16, 1943. 582,009.

Method of manufacturing chlorine dioxide.—S. H. Persson. Dec. 22, 1942. 581,931.

Execution of catalytic conversions in the presence of ferrous metals.—Shell Development Co. March 28, 1942. 581,902.

Isomerising hydrocarbons.—Shell Development Co. May 16, 1942. 581,904.

Production of alkylated aromatic compounds.—Shell Development Co. April 19, 1943. 582,034.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

BOUVERIE HOUSE, 154 FLEET STREET, LONDON, E.C.4

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1433. December 14, 1946 **Annual Subscription 21s. Overseas 26s.**

The Coal-Chemical Transformation

IT seemed to us that many hopes were dissipated when the reports of the CIOS and BIOS teams on the German synthetic oil plants were published. A wide-spread belief was abroad that there had been great developments in Germany behind whatever curtain Hitler was able to maintain. It was believed in many quarters, even before the war, that Germany was actively developing the production of chemicals from coal and had done so with considerable success. To be sure a gentleman whose name is well known in the chemical industry told us how he had been feasted in Berlin upon " butter " made from coal—and that he liked neither the taste nor the effect of the material upon his stomach; but that we dismissed as an unfortunate early attempt, which would doubtless be vastly improved upon at no distant date. We were credibly informed by those who claimed to know that by 1939 at least 20 Fischer-Tropsch plants were in operation. Our own knowledge ran to no more than three or four such plants, but the tale was too circumstantial to be disbelieved. It was clear that since the Germans were dependent upon *ersatz* material they would continue to build such plants in large numbers; those who did not know the facts were convinced that the whole of Germany must be covered by synthetic works manufacturing chemicals and *ersatz* foods from coal. It was equally obvious to everyone that with the immense German capacity for scientific research, the developments that had taken place during the war would be staggering. It therefore only remained for us to capture German Fischer-Tropsch plants and some of their more knowledgeable personnel to put ourselves in a position to set up a synthetic chemical industry in this country based on coal. Our investigating teams followed so closely on the heels of the Army that they were in the Fischer-Tropsch plant as the Army moved on to take the next position.

But alas for these hopes and expectations. The sober scientific truth as disclosed (THE CHEMICAL AGE, Nov. 9, p. 569) by Dr. C. C. Hall, of the Fuel Research Station, who conducted much of the investigation is that the progress which was expected by almost everyone was not made. The vaunted German scientific ability has produced almost nothing that was not known before the war. There were but nine Fischer-Tropsch plants in Germany, and all of these were either in operation or under construction when war broke out. For synthetic petrol, the Germans relied rather upon hydro-

On Other Pages

genation, which produced about half the total German oil requirements. The Fischer-Tropsch process was a more highly skilled chemical operation demanding elaborate purification of synthesis gases, and would seem to be less well suited to petrol production that the relatively cumbersome but simple (in a chemical sense) method of hydrogenation under pressure. That in itself would be no cause for disappointment. We are not at the moment very interested in the synthetic production of oil from coal; it is upon chemicals that the economic emphasis is laid to-day. The Germans used their Fischer-Tropsch processes and plants rather in this direction. They produced first-class lubricating oils in these plants. They produced as primary materials, straight-chain paraffins and olefines, and they obtained these products to the extent of about 80 per cent of the maximum theoretical yield. Certain lower-boiling products were sold as petrol; higher-boiling products were used as Diesel oil, and altogether some 72 per cent of the total products reached the user as petrol, diesel and lubricating oils for the internal combustion engine. The remaining 28 per cent was converted into chemicals and special products, in particular soap. Oxidation of waxes to fatty acids, the production of aldehydes and of alcohols were prominent features of war-time research and production in these plants. The possibility and the methods for doing most of these transformations were known before the war. Research developments did not appear to have contributed to any considerable extent towards the improvement of the efficiency of the Fischer-Tropsch plants nor to reduce the cost of production. The impression created upon our mind is that the commercial position of the Fischer-Tropsch synthesis was much the same after the war as it had been when the war started.

What, then, is the future of chemical synthesis from coal by the Fischer-Tropsch process? As a method for producing petrol or diesel oil, the process is hopelessly expensive under British conditions the production cost, Dr. Hall calculates, would be about 2s. or 2s. 6d. a gallon of petrol. Several tons of coal—we believe the figure is 3 or 4 tons—are needed for the production of a ton of products; the world market price levels have moved against the Fischer-Tropsch synthesis because the price of coal in this country has gone soaring upwards while the price of petrol and diesel oil has not. It should be pointed out, however, that there are places in the British Empire where coal, and particularly brown coal, can be obtained on site at 4s. or so a ton. Under these conditions the production of oils for the internal combustion engine may be not only feasible but profitable. Dr. Hall points out, too, that the application of German research work which would enable a high proportion of the products to be utilised as high-priced chemical products would materially improve the economic prospects of the process. For real economic improvement, however, a reduction in the cost of the synthesis gas is needed. Plainly, the synthesis gas cannot be produced from coal at anything like British prices. It must be produced from products that would otherwise be wasted, such as natural gas or refinery cracking gas. The discovery of a catalyst not susceptible to poisoning by sulphur would be a useful improvement.

The needs of the Fischer-Tropsch synthesis are first to cheapen the process, and second to discover in what direction it should be developed. The need for cheapening the process is obvious. What is not so obvious, and never has been, is the requirement of the British chemical industry, either for home or export trade, for the chemicals that can be produced by that process. We should like to see a strong committee of inquiry set up to discover the possibilities in that direction. A parallel inquiry would be needed to ascertain whether those products would be best made by the Fischer-Tropsch synthesis or from the ethylene and other gases derived from coal carbonisation. If the findings of these inquiries should show that a case could be made out for economic operation of a Fischer Tropsch plant either now or in the future such a plant should be erected. There is general agreement that because we lack such a plant we have not gone as far ahead in chemical synthesis from coal as we might have done. The research work at the Fuel Research Station has been useful, but if there had been a commercial plant on which to operate we should probably have got much farther—even though the Germans, with their preoccupations with production of projectiles did not.

NOTES AND COMMENTS

FUEL AND THE FUTURE

PIONEER among British journals concerned exclusively with the cause of fuel economy in industry, the *Fuel Economy Review,* published by the Federation of British Industries, made its first appearance in 1921. The latest issue, Volume XXV, marks its silver jubilee. Circumstances affecting fuel supply twenty-five years ago had much in common with those prevailing to-day, but an editorial note in the jubilee issue, presenting comparisons, finds some differences which are highly significant if not alarming. In 1921 and for ten years after, the number of mine workers was such as to make over-production a potential problem; since then, however, the number has fallen substantially without prospect of much recovery. The need for all practicable means of fuel economy is therefore emphasised, despite the prediction of Professor M. L. Oliphant, F.R.S., Professor of Physics, Birmingham University—whose article on atomic energy and its industrial future is among the valuable contributions to the jubilee number—that within five to ten years it may be possible to develop the large-scale application of atomic fission and that, after fifteen to twenty years, this means of releasing energy may rival coal.

A CENTURY OF CHEMISTRY

WHEN we recall that one hundred years ago, when the Chemical Society was founded, Dalton's atomic theory was but thirty years old and the study of organic chemistry, as we know it to-day, still in its infancy, we realise how vast have been the advances in British chemistry during the past century. Fellows of the Society have been actively associated with those advances, so it is most fitting that, as part of the Society's centenary celebrations next summer, an exhibition is to be arranged depicting the achievements of British chemistry during the hundred years of the Society's existence and the part played by chemistry in modern every-day life. The exhibition, which will open in July for probably two months, is being organised by the Chemical Society in conjunction with the Department of Scientific and Industrial Research, and will be held in the Science Museum in London. The Society is to be responsible for the historical section, which will survey a hundred years' progress, while the Department of Scientific and Industrial Research will provide the exhibits illustrating the applications of chemistry in every-day life. The Agricultural Research Council and various research and other organisations are co-operating in the preparation of the exhibits, which are being gathered from many sources—from universities, from existing museum collections, from industrial concerns, as well as from private individuals. The Central Office of Information is undertaking the design and lay-out of this part of the exhibition. There seems every prospect of this exhibition ranking among the most comprehensive in the history of chemical science in this country.

THE NEW COINAGE

THE Royal Mint is working overtime on the production of our new cupro-nickel coins—which have the 1937 silver coin design, are dated 1947, and will be in circulation next year. This change-over to a new metal, which has caused considerable controversy, will demand an initial 16,000 tons of the alloy, and thereafter 800 to 900 tons each year for replacements. Apart, therefore, from the first demands, there will not be a heavy call on supplies of this metal, which will thus remain available for its many other uses. Tough, ductile, and capable of being cold-worked to a remarkable extent, cupro-nickel retains its bright finish in a pure atmosphere. Contrary to statements in the House of Commons, it is highly resistant to erosion, a fact which caused the British Admiralty to specify condenser tubes of this metal in their battleships 20 years ago. The alloy specified by the Admiralty, and now in general use for condenser tubes, contained 70 per cent copper and 30 per cent nickel, that is, 5 per cent less copper and 5 per cent more nickel than the new coinage will contain. Among other uses to which this centuries-old alloy has been put is for bullet-envelopes, aircraft radiators and in the electrical industries. Here cupro-nickel has proved extremely useful as a contact material and for resistance units. It has the special advantage of operating efficiently at high temperatures, in some cases 570 deg. F. Its resistance to wear and erosion are such that it is used for slip rings

for electrical machinery, particularly for large machines with long-running periods. One such slip ring of a 600 h.p. motor running at 700 r.p.m. over a period of 10 years, only wore to the extent of 1/10 in. This outline of the use of cupro-nickel indicates its toughness and usefulness. And although we may mourn the loss of our silver coinage, with all that it used to stand for, when we become accustomed to the new coinage we may take more kindly to it than some people would have us believe.

DUNLOP'S WAR EFFORT

RIGHTLY proud of their achievements, often in the face of seemingly insuperable difficulties, many firms in the chemical and allied industries have in recent months published in book form the stories of their war-time work in the national effort. Some have been plain, unvarnished accounts of day-to-day toil; others have been on more elaborate lines; but whatever their character they will all serve as valuable permanent records of stirring times and an inspiration for the days to come, particularly as (although unconsciously, perhaps) they stress the value of team-work. The Dunlop Rubber Co., Ltd., has gone a step further in making known to the general public much that was regarded as "hush-hush" during those anxious days of the country's peril and has produced a film story of Dunlop at war. We were privileged this week to see a pre-view of this film, which has the title of "Far Horizons" and is soon to be seen up and down the country. It is well worth seeing, portraying as it does, in a most acceptable manner, how the wheels of industry were kept moving to produce the wheels of war. Not only tyres—with which the name of Dunlop is chiefly associated in the minds of most—but numerous other types of rubber equipment, much of it most ingeniously contrived, came from Dunlop's 19 war-time factories, and the film, which includes actual scenes from Dunkirk, the Battle of Britain, and other epic events, shows how our gallant forces used them to the best advantage in the long march to Berlin.

USE THE REPORTS

AT the cost of many weeks and months work by thousands of British and American technicans, the secrets of German industry have been ferreted out in the past two years, and published under the initials of the various organisations. These C.I.O.S., B.I.O.S., and F.I.A.T. reports have brought to the doorstep of every British industrialist information about the set-up, plant and industrial secrets of his German competitors. Although these reports are easily available, it may be that all British manufacturers have not yet read, and profited by the publications of relevant reports. If they have not, they should harken to the words of Sir Stafford Cripps, who this week opened an exhibition of German Industrial Information in London. He said that it is urgently necessary for our manufacturers and producers to make the fullest and speediest use of this new knowledge. All of it, he warned them, will become out-of-date, so there is no time to waste if we are to get the full advantage of all this effort that has been undertaken. He appealed in particular to the smaller firms, who have no research departments, to allow B.I.O.S. to help them to introduce the latest manufacturing methods and processes. In associating ourselves with these remarks we would add that the period of subservience by German technicians appears to be drawing to a close. Our information is that they are now less inclined to divulge technical information than was the case immediately after the war. It may be the Government knows this too, and is sending few teams to Germany now. Another aspect of this matter is that to tell manufacturers to adopt new processes and methods implies provision of new plant. Where is this to come from? Are our exports of machinery (to equip would-be foreign competitors) to be reduced, or are we, at last, to obtain plant and machinery from German factories?

STRUCTURAL INSULATION

Those concerned with the ownership, design or management of industrial buildings need little reminder of the value of structural insulation in saving both the nation's fuel and their own expenditure. Nevertheless, they find worthwhile points of advice in the new booklet, "You Amaze Me, Young Man," obtainable from the Ministry of Fuel and Power (any regional office or the Fuel Efficiency Branch, Queen Anne's Chambers, Dean Farrar Street, London, S.W.1). The theory and practice of structural insulation are brightly demonstrated with examples, photographs and humorous sketches.

GERMAN USE OF LOW-GRADE FUEL WITH RICH OXYGEN*

by D. D. HOWAT, B.Sc., Ph.D., F.R.I.C., A.M.I.Chem.E.

PRESSURE gasification of fuel offers a number of interesting and important advantages, but serious practical difficulties have made developments extremely slow. In this country laboratory results have shown that an extremely reactive coke may be produced by carbonising in an atmosphere of hydrogen under pressure. These facts lend considerable significance to the accounts of the high-pressure gasification process recently developed in Germany by Lurgi-Warmtechnik. The main object of the process is the continuous and complete gasification of briquetted or lump brown coal by the use of oxygen and superheated steam at a pressure of 20 to 30 atmospheres to yield a high calorific value gas suitable for domestic or industrial purposes.[1, 3, 6]

Pressure gasification of coal with oxygen and steam results in the formation of a gas with a relatively high carbon dioxide content, although such high values do not involve any real loss of heating value or efficiency of gasification. Formation of carbon dioxide arises solely from the conversion of carbon monoxide to hydrogen or to methane with the resulting formation of carbon dioxide and water, the conversion of the chemical energy not being influenced by the large carbon dioxide formation.

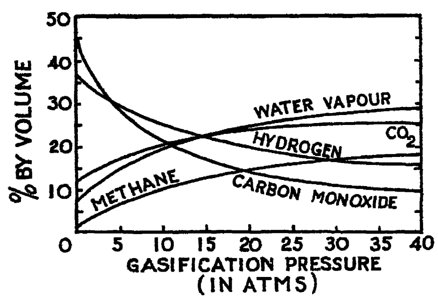

Fig. 5. Theoretical gas composition in relation to pressure, using oxygen/steam blast in pressure gasification.

Probably the most important factor in high-pressure gasification is the formation of methane. The reactions involved in methane formation are as follows:

$CO + 3H_2 = CH_4 + H_2O + 49.5$ K cals. per gm. mol.
$CO_2 + 4H_2 = CH_4 + 2H_2O + 39.56$ K cals. per gm. mol.
$C + 2H_2 = CH_4 + 18.07$ K cals. per gm. mol.

* Continued from THE CHEMICAL AGE, November 30 (see pp. 661-9).

These reactions indicate that the production of methane increases with increasing pressure and decreases with increasing temperature. Figs. 5 and 6 from Danulat's work[7] show the variation in the methane content in the gases with changes in pressure and temperature. As a result of using a high gasification pressure favouring the formation of methane, the oxygen consumption is reduced with a corresponding reduction in the energy required for the process as a whole.

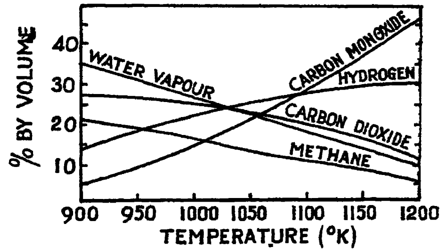

Fig. 6. Theoretical gas composition in relation to temperature, using oxygen steam blast in pressure gasification. (DANULAT).

Three high-pressure gasification plants have been built by Lurgi, the first being only a small unit of 5 million cu. m. per annum capacity at Hirschfelds. Two much larger plants were built later, one at Brux in Czechoslovakia with a capacity of 100 million cu. m. per annum and the other at Bohlen, near Leipzig, with a total capacity of 150 million cu. m.

Extensive investigations have been reported on the plant at Bohlen and a very useful critical analysis of the entire process has been published recently in the form of a BIOS report.[6]

The process may be briefly described as follows. Fuel is fed into the top of the generator, where it is dried by the hot gases from the process. Exit temperature of the process gases may be from 300° to 600° C., depending upon the water content of the fuel. At saturation the exit gases at 20 atmospheres have a partial pressure of water vapour of 8 to 10 atmospheres. The water content of the brown coal must be limited to 20 to 25 per cent. to avoid condensation in the drying zone.

Passing down through the generator, the dried fuel is carbonised by contact with the hot gases, the yield of tar obtained in this

way being high and comparable to that obtaining in atmospheric low-temperature carbonisation. Coking properties of the fuel are of first importance in high-pressure gasification. To ensure smooth, steady operation of the generator the fuel must not coke or stick during carbonisation. In this connection, coking properties at atmopheric pressure may offer little guide to the behaviour of the fuel in the generator under pressure. A very weakly coking coal may become strongly coking at high pressures, but instances have occurred in which weakly coking coals could be gasified quite satisfactorily.

Methane Formation

After passage through the gasification zone the fuel reaches the combustion zone at the base of the generator, where it comes under the action of the mixture of oxygen and steam blown in through the grate. The usual mixture of carbon monoxide, hydrogen and carbon dioxide is formed, but with practically no methane. As the gases rise through the fuel bed the fall in temperature, coupled with the high pressure obtaining throughout the generator, leads to the formation of methane in accordance with the series of reactions mentioned earlier.

The working temperature in the combustion zone is dependent upon the melting point of the ash, fusion of which must be avoided to ensure smooth, steady operation of the generator. Temperature control is maintained by the oxygen/steam ratio, the most favourable conditions being determined largely by trial and error for any given fuel. Any deviation from the optimum ratio considerably alters the performance of the generator. Increase in the temperature, resulting from an increase in the oxygen/steam ratio, reduces methane formation, while a decrease in temperature lowers the reactivity of the fuel and therefor slows gasification. Fuel with an ash of low melting point limits the permissible working temperature, resulting in the production of a gas with a lower calorific value and reduces the rate of gasification.

Investigation of the plant at Bohlen has yielded fully detailed descriptions of this, the largest, of these high-pressure gasification plants.[4]

The fuel used in the hydrogenation plant at Bohlen is brown coal carbonised in Lurgi "Spulgas" low-temperature carbonisation ovens to yield a tar suitable for hydrogenation. All the feed of brown coal, except the lump material, is briquetted after drying, 2¼-in. cubes being the standard size. In handling these cubes from the presses to the low-temperature carbonisation plant considerable breakage occurs at the corners. The broken pieces of briquettes, together with the lump brown coal, are treated in the high-pressure gasification plant, the approximate ratio of broken briquettes to lumpy material being 1 to 2. The average size of material fed to the generators is 3 to 10 mm., with a maximum of 20 mm. At the same time the percentage of material in the feed less than 2 mm. must not exceed 8.

Ten generators were installed at Bohlen, five built in 1940 and five in 1943, the rated capacity of each being 3000 cu. m. (105,000 cu. ft.) per hour, with a normal output of 2500 cu. m. (87,500 cu. ft.) per hour. The generator comprises three sections, the middle section being the generator proper. On top of the middle section the charging pouch is superimposed, while the ash is discharged into the ash pouch, comprising the bottom section.

On the more recent type of generator the charging pouch consists of a chamber approximately 9 ft. high, by 6 ft. 6 in. external dia. made of boiler plate steel, 1.65-in. thick. The cubic capacity of the pouch is 265 cu. ft. Two valves are fitted, one at the top communicating with the overhead fuel bunker, while the bottom valve opens into the generator. Both valves are conical in type and are operated manually.

During charging of the pouch the bottom valve is closed, the gas previously in the pouch being blown off to a subsidiary gasholder. When the top valve is opened a cylindrical sleeve drops into position in the aperture, being held in position by stops. Coal then feeds through the cylinder into the pouch. The main object of the cylindrical sleeve is to preserve the rubber sealing ring on the top of the pouch from abrasive wear by the coal feed and to prevent the lodgment of pieces of coal on the ring, causing bad fits when the valve is closed. When the pouch is full the cylindrical sleeve is raised leaving a clean contact between the conical valve seating and the rubber sealing ring. When the top valve is closed gas is allowed to enter the pouch from the generator through a by-pass pipe until the pressures are equalised. Then the bottom valve is opened, allowing the fuel charge to drop into the generator.

Details of Generator

The total volume of gas blown off from the pouch during the charging periods is 5 to 7 per cent of the total make, but this figure is not reported in the total make. Gas from the subsidiary holder is burned in a superheater raising the temperature of the steam for gasification to 500° C.

Constructed of an outer steel shell, lined with refractory brickwork, the generator proper, is a spherical-ended cylinder, approximately 22 ft. 4 in. in height and 9 ft. 3 in. in external dia. with a cubic capacity of 1240 cu. ft. The cylindrical portion is brick-lined from the top to within 3 ft. 4 in. of the grate. The bricks are set

dry in contact with one another and with the steel, and it is claimed that linings of this type have had a useful life of four years.

The generator is enclosed in a pressure cylinder 9 ft. 8 in. dia., constructed from steel plate 1.85-in. thick. The annular space between the generator and the pressure cylinder forms a water-jacket connected to a steel drum. The small proportion of steam produced (130 lb. per hour) is led into the gas-offtake so equalising the pressures inside the generator and in the water-jacket.

As shown in the sketch in Fig. 7, a skirt is provided around the fuel inlet to maintain a gas space over the fuel bed. This skirt also serves as a support for a system of scrapers for removing pitch and carbon deposits from the dome of the generator. Operated for a period of 6 min. every two hours the scrapers are driven by an electric motor at a speed of 10 r.p.h. Inside the skirt a conical ring is suspended with a double-cone beneath it to avoid segregation of the fuel and to equalise the pressure across the bed.

A very important feature of the generator is the rotary grate, the speed of rotation being determined by the quantity and character of the ash. Made slightly domed in form, the grate is composed of three sections in each of which a detachable portion is fitted incorporating a plough. The function of the plough is to direct the ash passing over the edge of the grate into a cylindrical space underneath. A vertical vane attached to the grate shaft, then scrapes the ash into an opening leading to the ash pouch. Oxygen and steam are admitted through the hollow driving shaft of the grate, the whole grate structure being supported from the generator shell. Shearing bolts are fitted as a protection against damage to the mechanical parts.

Ash passes from the generator into the ash pouch underneath through a valve exactly similar in construction to the bottom valve of the charging pouch, except that the dia. is 300 mm. instead of 250 mm. The base of the ash pouch is closed by a disc clamped by four swing bolts. A thin Klingerite packing ring set into the disc forms the actual joint and must be renewed after three discharges. Steam jacketing is provided on the ash pouch to permit cooling of the ash without condensation. Ash is discharged every two hours, oxygen and steam released on the reduction of pressure escaping to the atmosphere. When the pouch is closed again after discharge the pressure is built up again by the admission of high-pressure steam.

When the generator is operating normally the ash zone extends 12 to 20 in. above the grate, while the temperature in the reaction zone is 1050° to 1150° C. The minimum permissible melting point of the ash is about 1100° C. Fuels containing up to 30 per cent of ash have been successfully gasified, the average carbon content of the discharged ash being about 5 per cent

Granted reasonably normal conditions in

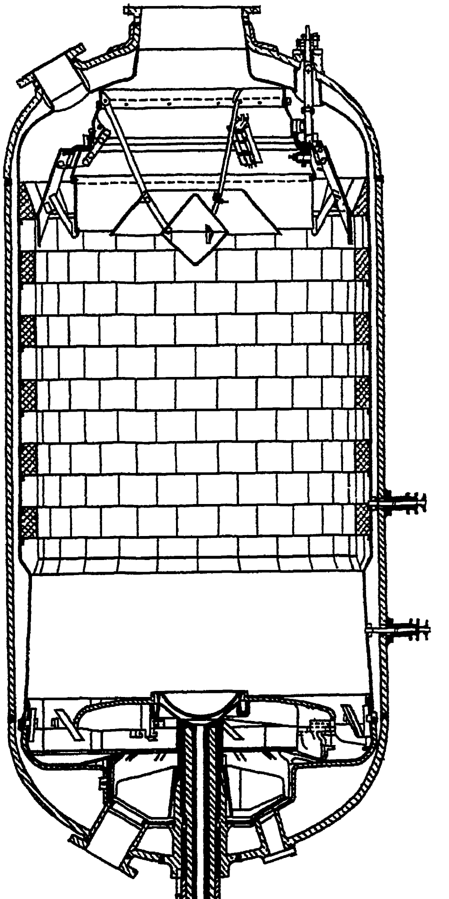

Fig. 7. Diagram of the Lurgi high-pressure generator at Bohlen. (B.I.O.S. Final Report 521).

operation it was claimed by the German operators that 250 consecutive days' work is possible in a generator, including short-time miscellaneous shut-down periods.

Control of the operation is effected mainly by the adjustment of the oxygen/steam ratio and by the rate of ash discharge. To maintain the output of high calorific value gas the quantity of steam used must be as low as possible, the exact ratio of oxygen to

steam being determined largely by the character of the ash of the fuel. Should sintering occur excess steam must be admitted. Slag formation and clinkering is indicated by fluctuations in the water-jacket temperature, by variation in the gas-make

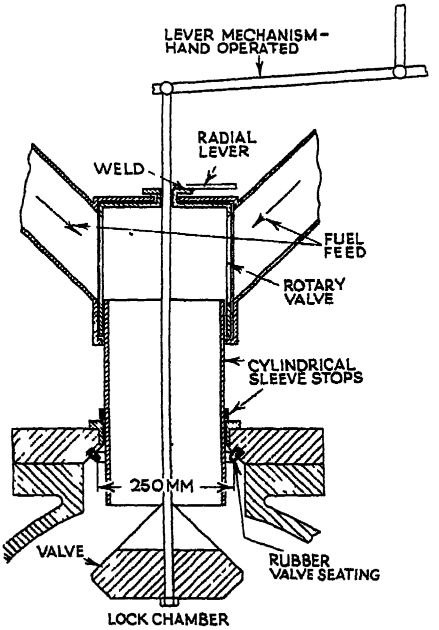

Fig. 7a. Diagram of fuel feed to upper chamber, Lurgi high-pressure gasification plant at Bohlen.

accompanied by a rise in temperature at the outlet and by an increase in power consumption of the ash extractor.

Ash removal must also be carefully adjusted in accordance with the generator load. Insufficient removal of the ash causes the gasification zone to move upward with a rise in the outlet temperature of the gas, while too rapid removal results in a loss of fuel.

Gasification is continuous, the intervals between charging the pouch depending upon the relative sizes of the pouch and generator. Charging interval with the older generators is 20 minutes, but with the latest type 35 to 45 minutes while labour requirements on the new designs are reduced from five men to two on the charging platform. It is claimed that a generator may be started up from the cold in 12 to 18 hours, air being used in place of oxygen during the greater part of the starting-up period.

Oxygen is supplied by a Linde-Frankl plant housed in a separate building, the plant comprising two units* of 35,000 cu. ft. per hour capacity and 70,000 cu ft. capacity respectively. Oxygen of 95 per cent purity is supplied and is compressed to 23 atmospheres before feeding to the generators. The temperature of the oxygen entering the generators is about 40° C Installed power in the oxygen plant is 4600 kW.

Gases from the generator must be cleaned from tar, and carbon dioxide and hydrogen sulphide before being fed to the distribution grid. Leaving the generator at a temperature of about 300° C. the gases pass through an off-take pipe, fitted with water-sprays, to a separate spray cooler. The design of this spray cooler had apparently given some trouble as evidenced by frequent alterations in design. Tar is discharged through a trap and the water is recirculated through an indirect cooler. Exit gases, from the spray coolers, at a temperature of 150° C. pass thence through two vertical water-tube primary coolers which reduce the gas temperature to about 100° C. This is followed by treatment in a tar precipitator and then in three vertical water-

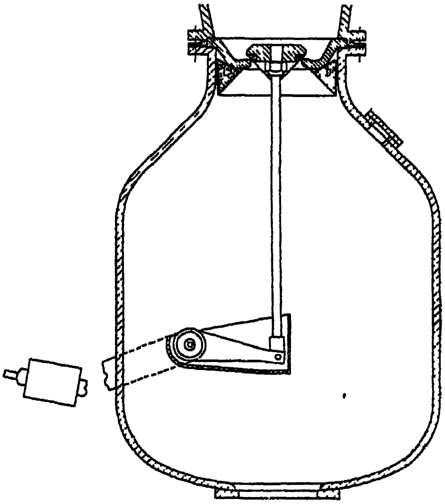

Fig. 7b. Diagram of bottom valve of upper lock chamber, Lurgi high-pressure gasification plant at Bohlen.

tube secondary coolers, which condense out light oils. Benzole is then recovered by washing with oil in a Raschig ring scrubber. Carbon dioxide and hydrogen sulphide are removed by washing with high pressure water in two 69 ft. towers packed with Raschig rings. Water from the base of the towers is passed through a Pelton wheel turbine to recover the work during the release of pressure of the water. The water is then passed through two aeration towers,

the gases evolved being led to the power house where they are burned for steam raising. Special 23 per cent chromium steels are employed when dealing with water containing carbon dioxide and hydrogen sulphide at 20 atmospheres pressure to prevent corrosion troubles.

Final sulphur removal is effected by passing the gases through Lux Box purifiers. The boxes are arranged in batteries of four, three of which are in use at any one time, the fourth being recharged, the working life of a charge in a box being about four weeks. Total loss of pressure in the whole cooling and purifying plant is about one atmosphere, the gas passing to the district transmission grid at a pressure of about 19 atmospheres.

TABLE V

Lurgi- High Pressure Gasification Plant at Bohlen
Working Results for the year 1943

Total vol. of purified gas made ...	3,703,000,000 cu. ft.	
Gas Composition	Purified Gas	Crude Gas
CO_2 per cent.	7.7	32.4
CnHm „	0.9	0.9
O_2 „	0.2	0.2
CO „	18.7	13.6
H_2 „	49.6	35.1
CH_4 „	22.1	15.4
N_2 „	0.8	0.8

Gross calorific value	456. B.Th.U./cu. ft.
Tar made	11,400 tons
Benzol made	4,408 tons
Mean daily gas production ...	10,140,000 cu. ft.
Maximum gas production on any given day	15.220,000 cu. ft.
Mean hourly generator output ...	94,400 cu. ft.
Mean generator loading of dried coal per hour	162.5 lbs. per sq. ft.
Total quantity of coal gasified ...	153,800 tons

Calculated composition of mixed coal feed.	Per cent.
Combustible material ...	68.1
Water ...	21.0
Ash ...	10.9
Tar content ...	13.6
Carbonisation water ...	26.9
Dry, ash free :—C ...	69.40
H ...	5.85
S ...	3.08
N plus O ...	21.57

Gross C.V. of coal	12,620 B.Th.U. per lb.
Gas yield on coal as delivered	24,180 cu. ft. per ton
Purity of oxygen used in gasification	95 per cent.
Total pure oxygen used in gasification	535,000,000 cu. ft.
Pure oxygen used per cu. ft. of purified gas produced... ...	0.144 cu. ft.
Total steam used for gasification	125,000 tons
Steam used per cu. ft. of purified gas produced	0.0765 lbs.
Total steam used in entire plant	152,100 tons
Total steam used in entire plant per cu. ft. of purified gas produced	0.092 lb.
Total electrical power used in plant	25,010,256 kWh
Electrical power used per cu. ft. of purified gas produced	0.00676 kWh
Plant water used	452,000,000 Imp. gal.
Plant water used per cu. ft. of purified gas produced ...	0.122 gal.
Recycled cooling water ...	77,800,000 Imp gal.
Recycled water used per cu. ft. of purified gas produced ...	0.021 gal.
Personnel required	Staff 15, Workmen 173
Total man-shifts worked ...	50,259
Purified gas produced per man-shift	73,560 cu. ft.

(B.I.O.S. FINAL REPORT No.521)

Table V shows the working figures for the year 1943, and is taken from the critical review of the process which has recently appeared."

TABLE VI
Estimated Costs of Gas Production at Bohlen.

	Pfennings per cu.m.
Coal :	
0.001598 tonnes at 6.5 RM. per tonne ...	1.04
Operating Charges :	
Electricity 0.256 kWh at 1.1 pf. per kWh	0.28
Steam 1.58 kg. at 0.21 pf. per kg. ...	0.33
Water 24.6 litres at 0.006 pf. per litre ...	0.15
Labour	0.40
Maintenance	0.40
(Miscellaneous—by difference on previous obtained figures)	0.27
Total	1.83
Capital charges :	
11 million RM. at 12.5 per cent. assumed	0.93
Total charges	3.80
Credit for by-products	1.40
Net cost of gas	2.40

(B.I.O.S. FINAL REPORT No. 521)

The following points are of interest so far as the cost figures are concerned. Power consumption for oxygen production in the Linde-Frankl plants was stated to be 0.9 to 1 kWh per cu. m. (0.024 to 0.026 kWh per cu. ft). This relatively high figure is accounted for by the inefficiency of the turbo-compressors, and it is hoped to bring this down to the equivalent of 0.021 kWh per cu. ft. The additional power required to compress the oxygen to 23 atmospheres for feeding to the generators is 0.2 kWh per cu. m. (0.0052 kWh per cu. ft.).

Total cost of production of the gas, as shown in detail in Table VI is given as 3.8 pf. per cu. m. (taking 12 RM. equal to £1) this is equivalent to 1s. 9½d. per 1000 cu. ft. After deducting a credit of 1.4 pf. per cu. m. the cost is reduced to 2.4 pf. per cu. m.—equivalent to 1s. 2d. per 1000 cu. ft.

Fuel consumption for process steam represents a considerable item of expenditure. Gases released from the charging pouch should provide about 23 per cent of the total steam requirements. The remainder. amounting to 70.8 lb. per 1000 cu. ft. of gas, or 15½ lb. per therm of gas, is supplied by burning brown coal in the boilers.

In the recently-published critical analysis of the Lurgi high-pressure gasification process a comparison is drawn between the efficiency of this system of gasification and the carbonisation of hard coal and of the carbonisation of hard coal followed by water-gas manufacture.

TABLE VII

The Efficiencies of Carbonisation and Gasification Processes

System	High-Pressure Gasification				Carbonisation		Carbonisation water-gas manufacture	
Fuel	Brown Coal		Hard Coal		Hard Coal		Hard Coal	
C.V. of gas (in B.Th.U./cu. ft.) ...	456		429		450		364	
	Therms	Per cent.	Therms	Per cent.	Therms	Per cent.	Therms	Per cent.
(a) Fuel required for steam ignored								
Per ton of coal treated	192.5	100	307	100	305	100	305	100
(All figures per ton of coal treated)								
Gas yield	110.2	57.3	259	84.5	93.4	30.6	187	61.3
Tar plus benzol	39.8	20.7	—	—	27.0	8.9	10	3.3
Coke plus breeze	—	—	—	—	134.1	44.0	—	—
Total thermal yield	150.0	78.0	259	84.5	254.5	83.5	197	64.6
Efficiency of gas production		72.2		84.5		65.0		63.4
(b) Fuel required for steam included								
Per ton of coal used	192.5	100	307	100	305	100	305	100
(All figures per ton of coal used)								
Gas yield	93.3	48.5	205	66.8	93.4	30.6	182	59.7
Tar plus benzol	33.7	17.5	—	—	27.0	8.9	10	3.3
Coke plus breeze	—	—	—	—	127.7	41.9	—	—
Total thermal yield	127.0	66.0	205	66.8	248.1	81.4	192	63.0
Efficiency of gas production		58.8		66.8		62.2		61.7

(B.I.O.S. FINAL REPORT No. 521.)

Ignoring the fuel required for steam raising, the Lurgi high-pressure process shows a distinctly higher efficiency of gas production as compared with the other two processes. However, after a very careful study of the fuel requirements for steam raising the authors of the survey[6] find, as shown in Table VII that the efficiency of gas production of the Lurgi process is slightly lower than the others when using brown coal. On the present insufficient data relating to the gasification of hard coal by this process the figures available indicate that the efficiency of gas production is slightly higher than in the other two processes.

All the evidence available goes to prove that the process has been found to be a commercial success. The degree of success achieved is particularly marked under the conditions of a steady output of gas.

These accounts of the German developments in the field of gaseous fuel manufacture by the utilisation of oxygen furnish conclusive evidence that an immediate investigation is required into the production of high-grade oxygen on a very large scale and at much lower prices than those presently obtaining. As a corollary to this, increased fields of utilisation of oxygen must be developed.

A steadily increasing volume of evidence from the U.S.S.R., the U.S.A., and Western Europe indicates that Britain is lagging badly in this new field. Utilisation of oxygen in gaseous fuel manufacture is only one of the many new lines of development which must be pioneered with speed and enthusiasm. The critical fuel situation confronting British industry at the present time is alone sufficient to warrant the fullest investigation and development.

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5 Metallgesellschaft Lurgi. Frankfurt am Main. *CIOS Item No.* 30, *File No.* XXXI—23.
6 "Lurgi high-pressure gasification." *BIOS Final Report No.* 521.
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HIGH TEMPERATURE RESISTING METALS

DR. A. McCANCE, delivering his presidential address to the Scottish Engineering Students' Association in Glasgow recently, emphasised the great necessity at the present time for steels which would perform satisfactorily at the increased operating temperatures met with in the present-day high-efficiency power generating plants. He gave an outline of creep testing methods and described a new development whereby results, which formerly took months to acquire, could now be obtained in about a week. He also described the procedure followed in creating new alloys specifically to meet the needs of a given set of operating conditions. Refering to the much discussed topic of gas turbines, Dr. McCance stated that metallurgical investigations into high temperature resisting alloys had greatly increased the life of these turbines, but that the stage had not yet been reached where their life was sufficient for their economical use in general industrial plant.

MANAGEMENT PROBLEMS

In order to assist subscribers in the solution of their management problems we invite questions relating to such matters as accounting, costing, control of plant and materials, office methods, income tax, etc. Correspondents will be answered under initials but should give their names and addresses which will not be published, and when documents of any kind are sent to us they should be copies only, as they cannot be returned. Letters should be addressed to the Editor.

Machine Costs

Query.—" We are about to start compiling machine costs for each of our machines, exclusive of operating labour costs, and would like to know the nature of the expenses to apportion in such cases."—G. & E.

Reply.—As regards repairs and cleaning, the actual cost per machine can usually be included, and to cover expenses such as fuel and power, rent and rates, depreciation, insurances, and workshop lighting and heating, etc., proportions should be charged against each machine, the total amount shown under these headings during the year corresponding roughly with the figures shown in the annual accounts. By ascertaining the total running hours and making deductions for lost time, the hourly machine cost of a machine can be arrived at.

Vouching

Query.—" My accountants have asked me to send them my purchases book for "vouching" purposes. What exactly is meant by " vouching " ?—L.A.

Reply.—The purchases book is wanted, presumably, in order that the original entries can be verified, and all invoices, debiting documents, credit notes, etc., should accompany the book. The items passing through the purchases book should be supported by the production of the documents received from the various suppliers, and the items can be vouched by comparing the entries with the particulars shown on the invoices, etc. On each form, and preferably in red ink, should be shown the page or folio on which the transaction appears in the book, and against each book entry should be inserted the number of the invoice, these numbers being shown in rotation in a column provided for that purpose. A separate file should always be kept for the invoices, and at the end of each month the documents can be removed from the file, wrapped up in a neat bundle and endorsed, leaving the file available for invoices relating to the current month.

Simplifying Sales Promotion

Query.—" As selling conditions become more complicated our sales records will have to include various sections of information, all readily found under one title. Can you suggest a suitable method of control ?"—F.R

Reply.—All the relevant facts should be available, and experience has proved that when once a proper arrangement of forms has been made, the information can be readily presented for action by a method of automatic signal control. A typical set of sales record forms consists of inquiries received, quotations made, result, daily record of orders obtained, and the monthly and yearly sales totals. The forms relating to each customer are usually housed in a pocket, and a permanent title strip avoids the need for re-typing the standing details every time a record card becomes full. As orders are received, calls made, etc., the signals are moved forward, and attention is drawn when an order fails to arrive or a call is not made at the right time, as the signals then lag behind the current position. Ups and downs in sales are thus automatically revealed, and a reliable summary of the sales position can be obtained. Now that business in some departments is again on the up grade, the amount of detail work is likely to increase, and if office overheads are to be kept within reasonable bounds a speedier and more accessible grouping of essential facts and data will be necessary.

At all times, office managers and senior clerks need to keep certain facts continuously before them, particularly in connection with such matters as the progress of sales, the best selling lines, the collection of outstanding accounts, variations in the orders obtained by agents, and fluctuations in market conditions and prices. When visible equipment is used, every vital detail can be referred to when it is needed, and to satisfy the requirements of all departments special records have been designed. There is now a wide range of systems, cabinets, fittings and frames for every type of business, and specialised skill and knowledge is freely placed at the service of the user, both before and after the equipment is supplied. There are many possible applications, and without moving from his or her seat an operator can reach as many as 30,000 cards. In some cases the cards are slotted at the bottom and stand vertically, each about half-an-inch to the right of its predecessor, this space being maintained by means of rods running from the front to the back of the drawer.

Adding Machine and Typewriter

Query.—" If it is possible to obtain a machine which combines within one frame a full keyboard adding machine and a typewriter, such a combination would be

extremely useful to me and I would be obliged if you could supply further information."—H.A.B.

Reply.—An outstanding feature of the modern accounting machine is that all the items recorded are visible for the complete length of the printing line, which means that the operator is never in any doubt as to what has been posted, or where it is to be posted. The automatic functions of these machines relieve the operator of everything except the actual depression of the keys, and this results in more work and a greater degree of accuracy. No manual effort is required to print or add figures, as the machine does this work when the motor bar is touched, and tabulation and return of the carriage is entirely automatic, as also are vertical spacing, printing of dates, descriptive abbreviations, printing of balances (both debit and credit) and the opening of the carriage upon the completion of a posting. One model is rendered particularly versatile and flexible by a stop bar feature, the bar being clipped on to the front of the carriage. When in place, this bar controls the machine for one particular job, say, sales ledger work, and when it is replaced by another bar the machine is completely ready for an entirely different job, say, stores accounts or costing. Some of these machines now handle as many as 20 different jobs.

Planning Future Operations

Query.—"I cannot help feeling that with conditions as they are to-day, chemical traders would be well advised to plan their operations well ahead and adopt more suitable methods of accounting. Without converting business management into a mechanised operation, it should be possible to co-ordinate all departments in carrying through a pre-determined plan based on estimates. I am sure a little guidance on the subject of budgetry control would be welcomed."—M.C.

Reply.—In order to be in a position to plan operations covering a period of one year or six months, reports would be needed from managers and charge hands, whose duty it would be to carry out the firm's general policy. While the judgment of managers can often be acted upon, the views and opinions expressed by foremen and assistants cannot always be accepted. Owing to their position, the majority of managers are able to draw on facts, and, of course, this materially simplifies the preparation of an estimate which can be divided into time periods by reference to the class of goods. Some chemical traders estimate their turnover over a definite period and convert these figures into index numbers, sufficient allowance being made for publicity, competitive efforts, etc. The percentage relation of each group of expenditure can then be shown. Past results should be studied very carefully in relation to the orders and inquiries received, and naturally the market prospects have to be analysed in the light of the reports received. The labour situation and the finances must also be taken into account. While a budget can often be prepared on these lines, the results may be affected by seasonal variations or by influences that are incapable of prediction. The probable sales of different chemicals can sometimes be predicted by ascertaining the trend of expansion and by preparing curves showing past ups and downs, and as the costs of selling will be closely related to this data the planning of a programme would be of little practical utility unless estimates are also made of the selling expenses.

New Sweetening Agent

Dutch Chemist's Discovery

CLAIMED to be 4000 times as sweet as sucrose, a new compound has been discovered by Dr. P. E. Verkade, of Delft Technische Hoogeschool. It is now being manufactured in Holland and has been successfully used there and in other Continental countries.

Reporting this to the American Chemical Society recently, Dr. Verkade said the new substance, most important as a sweetening agent among a series of compounds investigated by him during the war, is 1-*n*-propoxy-2-amino-4-nitrobenzene. The compound forms orange-coloured crystals and is easily obtained in a pure state. Unlike saccharine, it is constant in boiling water and in weak acids, and has been proved harmless upon ingestion. Its solubility in water, though, is low—136 mg. per litre at 20°C.—but a saturated solution is equal in sweetness to a 50 per cent sucrose solution.

Dr. Verkade describes the *n*-propoxy compound in its pure form as so sweet that the smallest portion of it on the tongue can still be tasted half-an-hour later. Despite this it can be used as a sugar substitute if diluted with some substance such as lactose to provide a product about 500 times as sweet as cane sugar.

Covering the varied uses of zinc and including technical articles and data sheets, *Zinc Bulletin* (No. 1 new series), published by the Zinc Development Association, Lincoln House, Turl Street, Oxford—from whom copies are obtainable—makes a welcome appearance. The original "Technical Bulletin" was abandoned during the war, since when the Zinc Alloy Die Casters and Zinc Pigment Development Associations have been formed; and the revived publication, coming out quarterly, is to cover the activities of all three associations.

TRANSFORMER AND TURBINE OIL

by J. W. MINKEN and C. v. GRONDELLE

DURING the past twenty years we have had considerable experience of transformer and turbine oils. In the following paragraphs some account is given of the tests we use and our methods of regeneration of the oil.

After a new oil is sent to the laboratory for the usual tests, such as those for viscosity, cloud-point, acidity, saponification, etc., comes the difficulty of choosing between seven or more different sludge tests. The problem here when testing different oils is that one method may show "A" to be the better oil, whereas another test may show "B" to be better. The reason is that too little is at present known about the chemical reactions of mineral oils and their chemical construction. The best procedure is to determine upon a test which works under conditions approximating to those in a transformer.

The general outline of one such test, devised by Weisz and Salomon, is as follows. Ten test tubes are filled with 65 c.c. oil and heated to a temperature of 230°F., which is kept constant. The catalyst is a copper wire. One of the test tubes is inspected every hour until it is observed that sludge is beginning to form. This happens, say, in x hours, when this tube is then taken out of the heater, and 5 c.c. of the oil used to determine acidity and saponification. The remainder is diluted with a special kind of paraffin, put in a dark room for 24 hours,

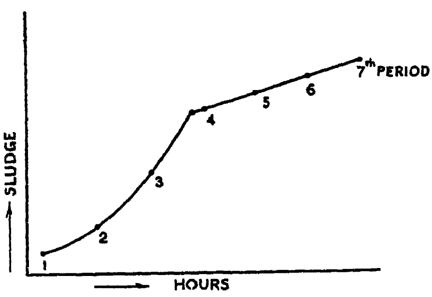

Fig. 1. During the five periods this is parabolic and then linear. An oil of this type is the best possible, as it is not too strongly refined, and is "indifferent," or neutral (i.e., the sludge formation will not change very much when the oil is used in the transformer).

and then filtered. The filter is dried, and it is thus possible to determine sludge formation in the tube. The second test tube is taken out of the heater after 2x hours, the third after 3x hours, and so on, the subsequent treatment being the same as in the case of the first tube. The quantities of sludge and the times in hours enable a graph to be drawn.

This graph and length of period, the quantity of sludge formed in the first period, and the acidity indicates the quality and type of oil. The graph consists of two parts, the first parabolic, and the second linear. The curve can change its parabolic form into linear at or after the sixth period. Four possible cases are illustrated with their results, in Figs. 1, 2, 3 and 4.

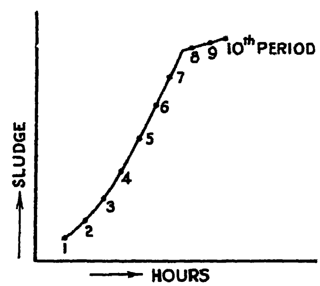

Fig. 2. Here the curve is more than six periods parabolic, so that this oil also is not too strongly refined, but it is already "not indifferent," so that the curve will change much more after the oil has been used for a few years. The oil is good, but inferior to No. 1.

The authors' practical experience has taught them that when Weisz and Salomon's test shows that the oil "A" is better than "B," "A" proves to be better in the transformer or turbines than "B." They point out, however, that in most cases it is very difficult to make a decision as circumstances vary with each transformer. For example, the temperature of the transformer, the power input and output, the room in which the transformer has been placed, the metals used, the varnish, the construction and so on, all have an influence on the oil. It appears necessary to try different types of oil in new transformers which are exactly the same, and to compare the results. Whereas it used to be the general opinion that the best way to test an oil was when it was being used, the authors' experience has shown them that laboratory tests are sufficient.

All the transformers under the authors' care are overhauled and tested every four years or less, the oil-switches are tested every year, and when the resistance (break-

down voltage) is lower than 80 kV the oil is cleaned by centrifuging which removes any carbon or water. The turbine oil is

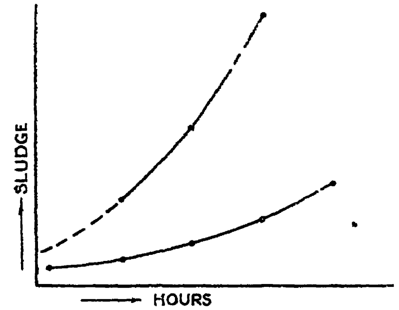

Fig. 3. This graph has two parabolic curves which show that this oil is too strongly refined.

tested for water every week, and a sample sent to the laboratory every three months to determine its acidity and saponification. (The acidity number is mgr.KOH, necessary to neutralise 1 gram of the oil, and

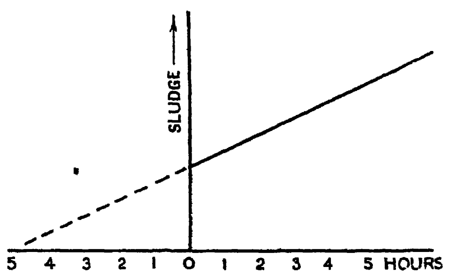

Fig. 4. Shows an oil which has already formed sludge in the transformers.

the saponification-number is mgr.KOH, necessary to saponify 1 gram of oil.)

When the acidity number is more than 1.2 or the saponification over 3.5 the transformer or turbine oil is replaced. By some it is thought that higher limits are permissible, but the authors have noticed that when the acidity is higher there is often serious sludge formation, especially in the turbines. They carried out sludge tests to find the reason for this with a different catalyst and using an alloy of Sn. and Pb. As can be seen from Figs. 5 and 5a there is considerable sludge formation with an acidity of 1 5, so it was decided not to have a higher acidity than 1 2.

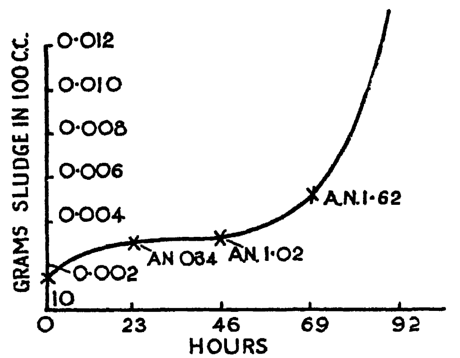

Fig. 5a.

The spent oil from the transformers and turbines is sent to a regeneration plant, which has a capacity of 10,000 lb. each day, and the regenerated oil is ready in four days. The oil is centrifuged at low temperature, and washed with a NaOH solution; saponification of the sludge follows. The oil is then washed with water and dried by centrifuge. During regeneration, 1 1.5 per cent transformer oil and 1.5 3 per cent turbine oil is lost. Before it is ready for use again, after being regenerated,

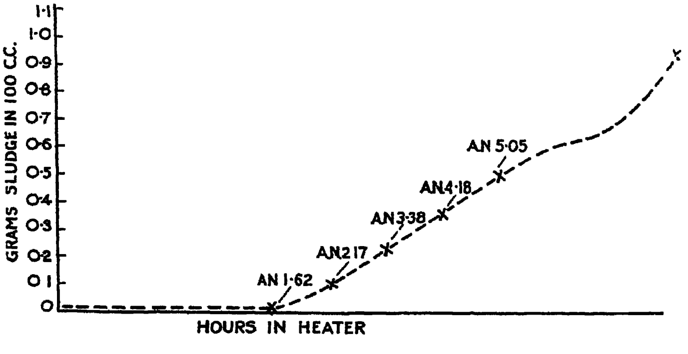

Fig. 5.

the oil must have an acidity number below 0.1, a saponification below 1.0 and the breakdown voltage should exceed 150 kV.

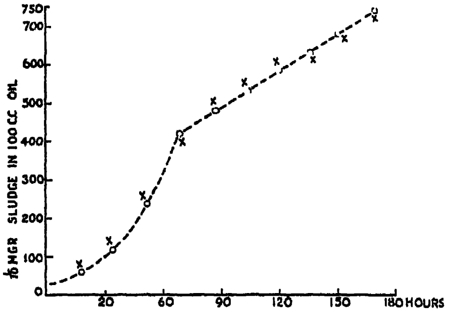

Fig. 6. Old oil treated in regeneration plant with NaOH solution.

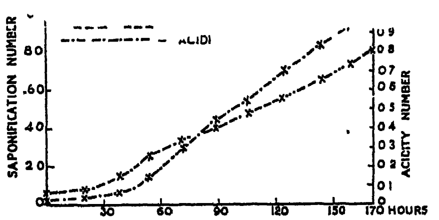

Fig. 6a.

The authors carried out tests with regenerated oils, of which the following is an example. (*See* Figs. 6 and 6a.) The curve is four periods parabolic and then becomes linear, which means a very " indifferent " type of oil. The period of 17 hours is fairly good. The sludge formation is of the usual character, as are the acidity and saponification curves, showing that the regenerated oil is as good as a new oil. A comparison is shown in Figs. 7 and 7a. These curves are from a new (Bataafs Petroleum Maat.) Shell type K8 oil. The sludge curves, the period and the saponification are about the same, and the acidity is only different in the last period (0.2 lower), but that is of little importance. Thus it can be seen that regenerated oils are at least as good as new, sometimes better, as will be seen from the following example: An over-refined oil of the type shown in Fig. 3 was used in a turbine from April 4, 1926, to 1930 and

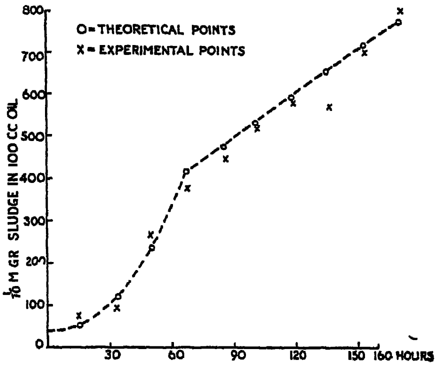

Fig. 7. Curve of a new Shell oil, type K8.

worked 20,240 hours; it was then regenerated and used until 1936, doing an extra 34,442 hours. Although the turbine had worked one and a half times as many hours as when first used, there was no need to regenerate the oil again. This experiment, however, could not be continued as a new turbine was installed. The condition of the oil before and after regeneration is shown in Fig. 8.

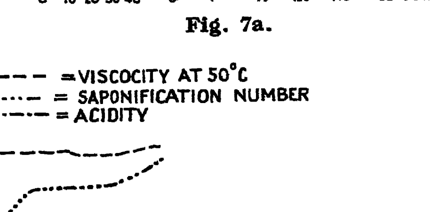

Fig. 7a.

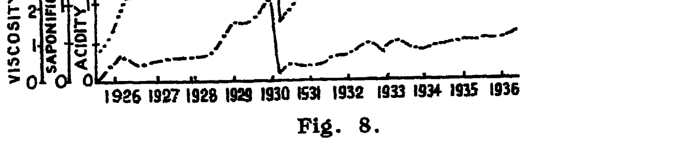

Fig. 8.

From the foregoing it may be concluded hat unrefined oils contain some organic substances that protects the oil more or less 'rom oxidation, but that when the oil is too highly refined, this substance also is removed; but during the time that the oil is n the transformer (and even during the test vhen the curve changes its parabolic form nto linear) this substance is formed again as indicated by change of curve from parabolic to linear. When regeneration of the oil has taken place, an oil of the Fig. 1 type is obtained.

More information about this sludge test can be found n:—
Erdöl und Teer 7 by Salomon (p. 415, published 1939).
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Erdöl und Teer 7 by Flamano (p. 399, published 1931).
Hochspannungsconferenz Bericht No. 7 (1929) and No. 18 (1931), by Pelisier.
Hochspannungsconferenz Bericht No. 3 (1929) and No. 3 (1931), by Weisz and Salomon.

Paint Manufacturers

Annual Dinner

THE annual dinner and dance of the National Federation of Associated Paint, Colour and Varnish Manufacturers of the United Kingdom took place at Grosvenor House, London, on December 4.

Under the presidency of Mr. C. Owen Morley, the company included notable guests, among them Sir Alan P. Herbert, M.P., who proposed the toast of "The Federation" wholly in verse; and response came from Mr. Norman J. Campbell, a director of the Association, who urged that never were trade associations more necessary than to-day in the interests of manufacturers and in the national interest. There was also room, said Mr. Campbell, for closer relations with those who used the products of the paint industry.

Mr. H. J. Hutchinson, C.B., C.B.E., Under-Secretary, Board of Trade, replying to the toast of "The Guests," proposed by Mr. R. H. Archer, acknowledged the paint industry's co-operation, particularly in the problem of "shortages."

In addition to those mentioned, the guests included: Mr. Brian Betts, president of the National Association of Wholesale Paint Merchants; Mr. John P. Halpin, Assistant Secretary, Board of Trade, Raw Materials Department; Dr. H. W. Keenan, Ph.D., F.I.C., president of the Oil and Colour Chemists' Association; Mr. C. A. Klein, president of the Research Association of British Paint, Colour and Varnish Manufacturers; Dr. L. A. Jordan, A.R.C.Sc., D.I.C., F.R.I.C., M.I.Ch.E., Director of the Research Association; Mr. A. E. L. Robey, vice-president, Building Industry Distributors; Lt.-Col. R. S. Sisterson, president of the National Federation of Master Painters and Decorators of England and Wales; Mr. G. L. Watkinson, C.B., M.C., Under-Secretary, Board of Trade; Mr. E. V. Watering, chairman of the National Joint Industrial Council for the Paint, Colour and Varnish Industry; and Mr. F. W. Webster, president of the Federation of Painting Contractors.

"Concentration of Soda Ash"

North-Western Engineers Meeting

AT a meeting of the North-Western branch of the Institution of Chemical Engineers, at the College of Technology, Manchester, on November 30, a paper entitled "The Concentration of Caustic Soda" was read by Mr. K. A. Sherwin, B.Sc., A.C.G.I. Mr. J. McKillop was in the chair.

The paper was prepared from the author's answer to a question in the home paper for the Institution associate membership examination in May, 1944, and should not be regarded as dealing with an actual manufacturing process, but rather as the point of view of a chemical engineer confronted with a problem outside his previous experience

The question was: How would you design a complete installation for the production of solid caustic soda based on modern practice? Weak caustic liquor 10 per cent NaOH by weight is available continuously at the rate of 15 tons per hour; also an adequate supply of cooling water at a temperature of 15°C. Steam and/or other sources of heat may be adopted." A brief survey of the literature suggested that the plant should be designed to handle liquor made by the lime-soda process.

Preliminary calculations enabled the author to construct his materials flow-sheet and to determine the unit operations, the types of plant and their capacities. The author considered various arrangements of plant and finally decided that the most economical treatment of the weak liquor consisted of the evaporation to 50 per cent concentration in a triple effect, backward fed, forced circulation evaporator; crystallisation of the sodium carbonate impurity in a Swenson-Walker crystalliser; filtration to remove the crystals; concentration of the filtrate to 75 per cent caustic soda in a single effect evaporator; further evaporation of water in two stages in open pots, and the removal of impurities by the addition of sulphur, followed by a settling period in the pots before pumping the clear, hot liquor into drums for shipment.

German Industrial Information

Exhibition in London

An exhibition which was opened in London on Monday by the President of the Board of Trade, Sir Stafford Cripps, represents the notable results of the research work of more than ten thousand investigators—British and allied industrialists, technicians, scientists, and others—who went to Germany in three thousand separate teams to prepare reports on German technical and scientific discoveries.

Known as the British Intelligence Objectives Sub-Committee, these teams of experts have now made available to trade and industry in this country a vast store of information concerning important German manufacturing processes and technical developments. Already 1390 of their reports have been published—many of which have been quoted in The Chemical Age.

The exhibition illustrates in interesting form how they went about their task and also presents—some of them for the first time—actual models exemplifying Germany's wartime progress in science, heavy industry, consumer goods, and nutrition. Among the exhibits are some dealing with powder metallurgy—the technique of manufacturing metal powders and heating and pressing them in a die. Others demonstrate advances in the manufacture of aluminium alloys.

As we announced last week, the exhibition is being staged at the Cinema in I.C. House, Millbank, London, S.W.1. It will remain open until December 19 from 10 a.m. to 5 p.m. (Saturday, 10 a.m. to 1 p.m.). Later it will tour the principal provincial towns. Trade cards are necessary for admission.

In his opening speech, Sir Stafford Cripps explained that the British Government knew a great deal of scientific and technical development had taken place in Germany during the war and they had, he said, to devise some way of making that information quickly available for our own industries.

Even before the war was over, there was an Anglo-American organisation known as C.I.O.S. (Combined Intelligence Objectives Sub-Committee), which followed the advancing armies and studied on the spot and reported on these technical developments. After the war was over, the combined organisation was replaced by the British B.I.O.S. and the American F.I.A.T. (Field Information Agency Technical). Since then B.I.O.S. and F.I.A.T. had worked in close co-operation.

This work, Sir Stafford pointed out, had also been a joint effort of the British Government and British industry, on the basis that all the information gained should be available for the whole of industry.

Referring to the work of the investigators, he said more than ten thousand separate factories and business premises had been visited. A great mass of German documents had been obtained — research memoranda, technical reports, patent specifications (of which there were over 70,000) and such documents. Scientists and specialists in Germany had been questioned and some had been brought over to this country for that purpose, while a very few highly qualified German technicians in special branches of industry had been brought here to work on research for which there was available no qualified British personnel. It had been the job of the B.I.O.S. to edit and index the valuable material thus collected and make it available for British industry.

Nearly a million copies of the B.I.O.S. reports had gone into circulation, Sir Stafford mentioned, in addition to which there was a mass of more detailed material available through an Information Bureau set up to service industry in these matters. For the many original German documents now in their possession, the Document Unit of the Board of Trade was the main depository, with facilities for translating, abstracting and supplying copies.

"What I should like to emphasise," he went on, "is the urgent need for our manufacturers and producers to make the fullest and speediest use of this new knowledge. All of it will become out-of-date, some sooner than other, so that there is no time to waste if we are to get the full advantage of all this effort that has been undertaken.

"I would particularly appeal to the smaller firms who have not their own research departments to allow B.I.O.S. to help them to introduce the latest manufacturing methods and processes.

"This is all part of our drive to increase production and to improve our competitive position in the world markets. The Information Section of B.I.O.S. is at 37 Bryanston Square, London, but any of the Regional Offices of the Board of Trade can tell manufacturers how best they can get the information they need.

"All the great organisations in industry have stressed the need for research as the basis of industrial progress, the same thing has been emphasised in the Reports of the Working Parties on individual industries. Here then is an opportunity—not to do the research which is costly and slow—but to take full advantage of all the intensive research in Germany throughout the war."

PARLIAMENTARY TOPICS

German Plants for Reparations

IN the House of Commons last week, the dismantling of factories in the British zone of Germany for reparations was subject to questions by several Members to the Chancellor of the Duchy of Lancaster. Mr. Stokes asked at what date the earmarking of factories for reparations would cease, in view of the fact that it had been agreed at Potsdam that such scheduling should be completed not later than February 2, 1946. Mr. Hynd replied that, as he stated in the last debate on Germany, February 2, 1946, was the date on which the level of industry, which would determine the total amount of surplus plant available for reparations, was to be decided and not the particular plants to be earmarked. The selection of the most suitable plants within the limits agreed under the level of industry plan of last March was a process requiring careful consideration in the interest of German economy itself, and he regretted it was not possible to declare a final date for completion of the process at this stage.

Export of Glue: Asked by Mr. Erroll this week what steps he was taking to secure the retention in this country of all domestically manufactured glue, in view of the shortages at present restricting production in the motor manufacturing, abrasives and other industries, the President of the Board of Trade stated that, since June 1 last, export licences for glue had been granted only to the minimum extent necessary to maintain markets, and he did not think it desirable in the national interest to restrict them further.

Penicillin Lozenges: In answer to Mr. J. Lewis, who asked the demands from the Service Departments for penicillin lozenges since January 1, 1946, specifying the purposes for which they were used and the average unit content per lozenge supplied, the Minister of Supply stated that the demands totalled 515,000 lozenges, the penicillin content of which was 500 units per lozenge. The purposes for which they were used was a matter for the respective Service Departments.

Allocations of Linseed: In view of the shortage of linseed and linseed oil in the U.K., Sir F. Sanderson asked the Minister of Food the total amount it was anticipated would be imported between now and June 30, 1947, from the Argentine and India respectively.

The international allocation of oils and oilseeds for 1947 had still to be settled, Dr. Summerskill informed him. They hoped to obtain as much as possible, she said, and to ship it promptly. It was not possible yet to say how much would arrive before June 30 next.

Sir F. Sanderson also asked the estimated tonnage of the Argentine and Indian linseed crop of the present season and to what countries their surplus requirements were being shipped.

Dr. Summerskill knew of no official estimate. The international allocations of these crops were under consideration by the International Emergency Food Council but decisions had not yet been taken.

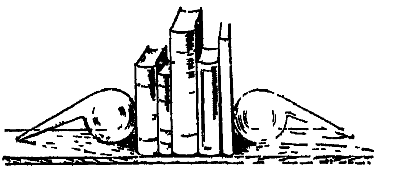
Scottish Iron and Steel Output: Information as to the average annual value of iron and steel output in Scotland and its relationship to that of England was asked for by Mrs. Mann, but the Minister of Supply said it was not available in the form required. In 1944 and 1945, he stated, Scotland produced approximately 15 per cent of the total steel ingot and castings production of Great Britain and nearly 13 per cent of the total iron casting production.

Rubber Imports: Mr. Belcher, in answer to a question by Sir Waldron Smithers, stated that £18,022,868 was the cost price (delivered to British ports) of the 139,958 tons of natural rubber and 2185 tons of synthetic rubber, this being the Government's rubber stocks on September 27, 1946.

Aluminium Alloys

Film on Heat Treatment

INTERESTING sidelights on the development of the British technique in the heat treatment of aluminium alloys are provided by a film which has been produced for the Aluminium Development Association. It should be in much demand by technical colleges and other similar bodies, by whom it may be borrowed on application to the Association's librarian at 67 Brook Street, W.1. The film runs for 18 minutes and copies are available in both 35 mm. and 16 mm. sizes for sound projectors only. Opening with the recapitulation in a modern laboratory of the initial discovery of age hardening made in Germany by Alfred Wilm, the film covers, by animated diagrams, the mechanism of age-hardening, hardening by cold working, and annealing. Then follows a description of the practical aspects of heat-treatment, lay-out of furnaces, and quenching tanks, with illustrations of types of furnaces actually used. The rolling of aluminium alloy sheets, their final heat treatment and flattening are depicted; and the film closes with a survey of modern uses of aluminium alloys.



A CHEMIST'S BOOKSHELF

Forensic Chemistry. H. T. F. Rhodes. 2nd Edition. Chapman and Hall. Pp. vii + 164. 15s.

This book has been completely re-set, in smaller type than was used in the original edition, and there is therefore a considerable saving of space. In the preface it is pointed out that certain sections have been almost entirely re-written because of recent developments in the field of forensic chemistry. Specially singled out for mention are those sections dealing with dusts, stains and the examination of toxic agents. In particular, it is stressed that the problem of dealing with such materials is essentially a microchemical one, and that considerable advances have been made in microchemistry which should be made available to the forensic chemist.

In view of this, it is to be regretted that the list of references at the back of the book is, item for item, identical with that contained in the first edition, with the exception that Chamot and Mason's *Handbook of Chemical Microscopy* is included (there being no indication that it is in two volumes with different publication dates.) The identity extends to the mis-spelling, in both lists, of Emich's name. Since Emich is one of the important microchemical experts, this does not arouse much faith in the extent of the microchemical revision.

Examining this list of references, as a key to further study, the uninformed reader must find it difficult to believe that no advances worthy of inclusion have occurred since 1940, the date of the first edition. His scepticism will be even further increased if to his notice is brought, for instance, Dr. Julius Grant's 4th English Edition and revision of Pregl's classic text-book. The one included in the list of references is the *first* edition, dated 1924. Again, the translations of Feigl's work, and Furman's revision of Scott's *Standard Methods of Chemical Analysis*, to mention only two other instances which caught the reviewer's eye, most assuredly ought to be listed. Conversely, it is doubtful whether, after these many years, Grey's *Practical Chemistry by Micro-Methods* is worth including, since it is rather an historical curiosity, and, as far as the reviewer is aware, is not readily available. The function of such a list of references is surely to be of the utmost help to the reader in extending his work, not merely to indicate what the author of the book has consulted. The author is failing in his job if he does not attempt to obtain the most up-to-date references for those whom he is serving.

Turning to the body of the book, one naturally examines with particular attention the microchemical techniques. A section has indeed been inserted which deals with microchemical methods. A number of crystal tests are described, and the reader is (properly) warned against their indiscriminate use. Indeed, the warning is so strong that he may well decide to leave them severely alone. Spot tests are discussed in general terms, but the description of individual tests included in the first edition is now omitted. The description of microchemical techniques proper would not benefit one already familiar with such operations from other experience. But the description is altogether too vague to be of much use to anyone who has not already used the techniques. The reviewer feels that the inclusion of a number of well-chosen diagrams in this section would enhance its value considerably.

It is well to keep this book in print, text-books on forensic chemistry are too few. But it is felt that a simple reprint would have served until such time as a proper revision could be carried out. In such a revision, since a number of misprints occur, the references throughout require overhauling from this point of view as well as from that previously mentioned. It might be added that some uniform system of indicating the page, volume number, and year of scientific journals should be introduced.

C. L. WILSON.

Plastics Applied. Edited by V. E. Yarsley, D.Sc., M.Sc., F.R.I.C. Second Edition Pp. 528 + LVI. London: The National Trade Press, Ltd. 1946. Price 42s.

This book is already well known to a wide circle of readers and its appearance in a revised and enlarged form is welcome. It is actually regarded as an encyclopædia of industrial plastics. The work is a co-operative effort of 25 authors, all engaged in this wide-spread, evergrowing field, in which is collected together a considerable number of appropriate surveys. That a second edition of the original work was called for is sufficient testimony both to the efficiency with which its aim has been attained and also to the growing interest which technologists

are taking in the daily progressing application of plastics.

The book consists of four main sections. Section I deals with matters of general interest to all users of plastic materials, giving a brief survey of the plastic industry and discussing the questions of design and colour possibilities when plastic materials are to be employed for any given purpose (pp. 13-41). Section II gives a review of the application of plastics in over thirty industries, written by leading authorities. The chapter on Plastics in the Manufacture of Chemical Plant by the editor, Dr. V. E. Yarsley, describes how plastic materials are used in chemical plant construction either as the main constructional material wherein the plastic forms the bulk of the unit, or as a protective coating on conventional constructional material, and as a lute or cement or sealing composition (pp. 42-419). In section III are discussed questions pertaining to health and safety precautions which should be observed in relation to personnel engaged in plastic manufacture (pp. 420-436). Section IV contains a large number of selected data and tables giving characteristics of the various types of plastic materials and also a comprehensive schedule of materials which are available, together with a list of trade names which will enable the user readily to get in touch with manufacturers of various proprietary brands of plastic materials pp. 437-522).

A full index to the book is provided and it is a very noteworthy feature of the work that each of the 36 chapters contains numerous illustrations, among them many coloured plates, and concludes with literature cited and with an up-to-date review of available technical literature and patents.

Although the chapters of the book are by different authors, the general treatment is similar, and the contributions have been well co-ordinated as far as subject matter is concerned. The book is a most valuable reference volume to the plastic literature and the editor is to be congratulated on the completion of a heavy task. One minor criticism is that in a future edition of the book it would be preferable to omit the numerous advertisements, as these do not quite conform with the special and impartial character of the book.

F. N.

Details and pictures of their new air-damped balances are included in No. 3 of *Towers Laboratory News*, just to hand from J. W. Towers & Co., Ltd., Victoria House, Widnes. "Output is increasing—we ourselves have several extensions in hand—and we look forward to the day when we can deliver all standard apparatus "off the shelf," is an editorial comment.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

COPPER & ALLOYS, LTD., West Bromwich. (M., 14/12/46.) November 14, charge, supplemental to a charge dated July 19, 1940, etc., securing £80,000 (not ex.), to N. M. Rothschild & Sons; general charge. *£60,000. January 12, 1946.

E. V. B. PLASTICS, LTD., Sutton (Surrey). (M., 14/12/46.) November 14, charge, to Barclays Bank Ltd., securing all moneys due or to become due to the Bank; charged on Windyridge, Brighton Road, Salfords.

CLASSIC CHEMICALS, LTD., Radcliffe. (M., 14/12/46.) November 5, £4000 charge, to J. Lord, Walsall, and orthers; charged on factory (formerly used as a brewery), Bury Road, and 11, 13 and 15, Bury Road, Radcliffe.

ANGLO-BURMA TIN CO., LTD., London, E.C. (M., 14/12/46.) November 15, Trust Deed dated November 15, 1946, securing £80,000 debenture stock, present issue £40,000; general charge (ranks as a first charge and in priority to £80,000 debentures, created April 5, 1937). *£78,587. December 12, 1945.

SAMUEL BROS. (PLASTICS) LTD., Manchester. (M., 14/12/46.) November 11, £950 mortgage, to Dr. Margaret R. T. Samuel, Salford; charged on premises being beerhouse and dwelling house in Owen Street, Hulme, Manchester, including site formerly known as 2/4/6 Owen Street. *£480. January 19, 1945.

BRISWORTHY CHINA CLAY CO., LTD., Plymouth. (M., 14/12/46.) October 28, £5000 mortgage, to A. Clough, Stoke-on-Trent, and £3000 mortgage (subject to above mortgage) to Mrs. D. M. Joste, Yelverton; charged on Brisworthy China Clay Works, fixtures, fixed machinery and plant and other properties, at Meany, Shaugh Prior and Bickleigh, and certain rights. *£2000 August 2, 1945.

Satisfactions

NATIONAL BITUMINOUS PRODUCTS, LTD., Reading (M.S., 14/12/46.) Satisfaction November 21, of mortgage registered August 15, 1938.

GLOVER (CHEMICALS) LTD., Lower Wortley. (M.S., 14/12/46.) Satisfaction November 2, of mortgage registered May 18, 1946.

NEXT WEEK'S EVENTS

MONDAY, DECEMBER 16

British Intelligence Objectives Sub-committee Exhibition. The Cinema, I.C. House, Millbank, London, S.W.1. Daily, 10 a.m.-5 p.m., until December 19.

The Chemical Society. The University, Leeds, 6.30 p.m. Professor Harold C. Urey: "Some Problems in the Separation of Isotopes."

Institution of the Rubber Industry (Manchester Section). Engineers' Club, Manchester, 6.15 p.m. Mr. J. M. Buist, Dr. D. A. Harper: "A Discussion of the Revision of British Standard Specifications for Vulcanised Rubber."

TUESDAY, DECEMBER 17

Institute of Petroleum (Northern Branch). Engineers' Club, Manchester, 6 p.m. Dr. L. Ivanovsky: "Report on My Visit to Germany."

Hull Chemical and Engineering Society. Church Institute, Albion Street, Hull, 7.30 p.m. Dr. F. R. Bradbury: "Field Trials with Insecticides in India."

Institution of the Rubber Industry (London Section). Waldorf Hotel, Aldwych, 6.30 p.m. Mr. G. L. Hammond, Mr. H. R. Poole and Mr. R. C. W. Moakes: "Silicon Rubber."

WEDNESDAY, DECEMBER 18

The Chemical Society. Royal Institution, Albemarle Street, London, W.1, 7.30 p.m. Professor H. C Urey: "Some Problems in the Separation of Isotopes" (Eleventh Liversidge Lecture).

Society of Chemical Industry. King's College, Newcastle-on-Tyne, 6.30 p.m. Dr. H. C. Craggs, Mr. H. M. Arnold, "Hydrogen Sulphide Removal by Ammoniacal Liquors."

THURSDAY, DECEMBER 19

The Chemical Society. The University Edinburgh, 5.30 p.m. Professor Harold C. Urey: "Some Problems in the Separation of Isotopes."

German Technical Reports

Some Recent Publications

SOME of the latest technical reports from the Intelligence Committees in Germany are detailed below. Copies are obtainable from H.M. Stationery Offices at the prices stated.

BIOS 737. Investigation of cast iron roll manufacture, with notes on the usage in rolling mill plants (11s. 6d.).

BIOS 766. Manufacture of pharmaceuticals and fine chemicals in the U.S. and French zones of Germany (35s.).

BIOS 831. Heat treatment of refractory materials (2s. 6d.).

BIOS 841. *I.G. Central Rubber Laboratory, Leverkusen*: Interrogation of Dr. P. Stocklin and Dr. H. Roelig. Synthetic rubber: Developing and testing (1s.).

BIOS 859. "Stellite" type alloys (1s.).

FIAT 717. Buna rubber research (5s. 6d.).

FIAT 741. Catalysts for coal hydrogenation (1s.).

FIAT 762. New plastics for aircraft (structural materials, glazings and paints (1s. 6d.).

FIAT 796. Bichromates manufacture (5s.).

FIAT 804. Molybdate orange pigment (1s. 6d.).

FIAT 807. Litharge and red lead process (2s.).

FIAT 809. Ferrocyanides and sulphur from gaswork residues (1s. 6d.).

FIAT 811. *G. Siegle and Co.*: Chrome yellow and other pigments (1s. 6d.).

FIAT 825. *I.G. Farben, Griesheim*: Chlorine dioxide and sodium chlorite (1s. 6d.).

FIAT 840. *Gesellschaft für Linde's Eismaschinen*: Calculation of regenerators for Linde-Frankl installation and overall utilities requirements for Linde-Frankl oxygen-producing unit (1s.).

FIAT 857 (I). Production of acetic acid at Burghausen and Knapsask; (II) Concurrent production of acetic acid and acetic anhydride at Knapsack (2s. 6d.).

FIAT 859 (I). Continuous chilling and cooling of calcium carbide; (II) Acetylene generation by dry type generators; (III) Purification and drying of acetylene for chemical use (2s. 6d.).

FIAT 861. Plasticisers for polyvinyl chloride (2s. 6d.).

Plans for additions to their plant at Wyandotte, Michigan, involving an expenditure of 25,000,000 dollars in the next 18 months, have been formulated by Wyandotte Chemical Corporation, Detroit. The extensions are expected to increase the company's chemical production by 100,000,000 lb. per annum. Hitherto, the company has been concerned only with the manufacture of inorganic chemicals, but it is now turning to the production of organic chemicals on a large scale.

Personal Notes

SIR WALTER BENTON JONES has been elected president of the British Tar Federation.

DR. W. H. GARRETT, M.B.E., technical director of Monsanto Chemicals, Ltd., has been appointed a Justice of the Peace for the county of Denbigh.

DR. A. B. MOGGY has been appointed Brotherton Research Lecturer in physical chemistry in the Department of Textile Industries at Leeds University.

DR. J. B. SUMNER, of Cornell University, who, as announced in THE CHEMICAL AGE of

November 23, has been awarded a Nobel Prize for chemistry.

PROFESSOR H. L. RILEY, Professor of Inorganic and Physical Chemistry at Durham University, has been appointed director of carbonisation research to the National Coal Board.

The late MR. JOHN HILL, joint managing director of Barker and Allen, Ltd., non-ferrous metal manufacturers, Birmingham, and chairman of other companies, left £65,842, net personalty £58,691.

MR. H. DRIVER, M.B.E., formerly Deputy Town Clerk of Oldham, has been appointed company secretary of Monsanto Chemicals, Ltd. MR. T. P. BERINGTON, who formerly occupied that position, will continue to act as an executive director of the company.

MR. HENRY WOODALL, deputy governor of the Gas Light & Coke Company, has resigned his seat on the board with effect from December 31, also his seat on the board of the South-Eastern Gas Corporation. The resignations are understood to be due to health reasons.

DR. ERIC CLAR, who has arrived from Czechoslovakia to work in the Chemistry Department of Glasgow University, as an I.C.I. Fellow, was formerly head of the Chemistry Department of the Instituto Rouzoni at Milan. For many years he has been particularly interested in polycyclic hydrocarbons.

DR. J. F. J. DIPPY, D.Sc., F.R.I.C., who has been head of the Chemistry Department of South-East Essex Technical College since 1945, has been appointed head of the Chemistry Department at Chelsea Polytechnic, in succession to DR. J. C. CROCKER, who is retiring. Dr. Dippy was formerly head of the Chemistry Department at Wigan Technical College.

Obituary

PROFESSOR F. M. ROWE, D.Sc., F.R.S., Professor of Colour Chemistry and Dyeing in Leeds University, and editor of the publications of the Society of Dyers and Colourists, died at Leeds on December 8, at the age of 55. He was born at Stroud on February 11, 1891, and was educated at Leeds University and the Technical High School, Brunswick. After some post-graduate research work at Leeds, he joined the firm of Joseph Crosfield and Sons, at Warrington, as research chemist. He transferred to the teaching staff of Manchester University in 1916, and 11 years later went to Leeds University. In 1932 he was appointed editor of the Journal of the Society of Dyers and Colourists, and in 1945 was made a Fellow of the Royal Society.

NEW RUBBER LATEX

The practical applications of a new form of natural rubber latex, "Positex," are described in a pamphlet published by the British Rubber Development Board, 19 Fenchurch Street, London, E.C.3. The author is Dr. C. M. Blow who, in a joint investigation carried out by the Wool Industrial Research Association and the British Rubber Production Research Association, evolved processes whereby negatively-charged rubber latex may be converted into positively-charged latex. In his pamphlet he explains the effects of this basic difference in colloidal properties. In the new form, the particles of rubber are positively charged over a range of pH from 3 on the acid side to 11 on the alkaline side. Since textile fibres are negative to an alkaline aqueous medium, the particles of rubber in "Positex" (unlike normal latex) are deposited on a textile fibre under correct conditions. Naturally the new form should thus give potential commercial advantages, not only in production but in resulting effects. Photographs included in the pamphlet, for instance, demonstrate the increased durability and retention of shape claimed for knitted worsted clothing made from yarn rubberised by the new process.

Home News Items

The Chemical Society is inviting applications for the post of general secretary. Dr. D. C. Martin, the present secretary, was recently appointed assistant secretary of the Royal Society.

The Control of Sulphuric Acid (No. 3) Order (S.R. & O. 1946 No. 2033) which amends the Control of Sulphuric Acid (No. 2) Order 1940, increases the maximum selling prices of sulphuric acid of strengths not higher than 155° Tw. at 60° F.

Excellent performances of "Death Takes a Holiday," a play in three acts by Alberto Casella, rewritten by Walter Ferris, were presented by the Johnson Matthey Dramatic Society at King George's Hall, Adeline Place, Great Russell Street, London, on Thursday, Friday and Saturday last week.

The control of ascorbic acid (vitamin C) has been transferred from the Ministry of Food to the Directorate of Medical Supplies, Ministry of Supply, Portland House, Tothill Street, London, S.W.1. Preparations containing ascorbic acid may now be supplied to factory welfare departments and applications should be made to the new address.

The Institution of Chemical Engineers and the Institution of Mining and Metallurgy were among organisations represented at a recent London meeting which approved the objects of the World Engineering Conference formed at the International Technical Congress held in Paris last September, and urged that it be actively supported by the organisations represented.

The Institution of Metallurgists is to open an Appointments Register as from January next with the purpose of putting in touch members seeking posts and employers with vacancies on their metallurgical staffs. Inquiries should be addressed to the Registrar, Appointments Register, Institution of Metallurgists, 4 Grosvenor Gardens, London, S.W.1.

A verdict of "Misadventure," death being due to an explosion of a thermite reaction mixture in a mixer, was returned at the inquest on a 17-years-old employee of High Speed Alloys, Ltd., Widnes, who died after an explosion in the mixing department on November 16 (see THE CHEMICAL AGE, November 30, p. 683). The process chargehand stated that every possible precaution had been taken. On behalf of the firm it was stated that the mixer had not since been used and that the management and H.M. Factory Inspectors were working on improvements which it was hoped would further reduce the danger element.

Changes in the prices of refined oils and imported edible animal fats allocated to primary wholesalers and large trade users during the eight-week period to February 1, 1947, are detailed on p. 753.

Pine pitch and pine tar oil will no longer be purchased on Government account. Imports in future will be entirely on private account. Applications for import licences should be made to Import Licensing Division, Board of Trade, 189 Regent Street, London, W.1.

Linseed oil has been mentioned in connection with a reported large-scale transaction between the U.K. and the Argentine, and it is anticipated that if the report is confirmed the price of the linseed oil will probably show a rise of about 15 per cent on the last bulk purchase made during the summer. This would bring it up to approximately £156 a ton.

A technical discussion, arranged by the Association of British Chemical Manufacturers, is to take place at Reynolds Hall, College of Technology, Manchester, at 3 p.m. on January 28, when Dr. A. C. Dunningham, of I.C.I. Ltd., will read a paper on "Fuel Efficiency in the Chemical Industry." Discussion will follow. Honorary members are invited and should notify Mr. W. Murray, Liverpool Borax Co., Ltd., Maxwell House, 5 St. Paul's Square, Liverpool 3, of their intention to attend.

The Oilseeds, Vegetable Oils and Fats and Marine Oils (Control) Order 1939 has been revoked, but its main provisions have been re-enacted in the Oils and Oilseeds (Control) Order 1946. The present restrictions on dealing in controlled oilseeds, oils and fats outside the U.K. have been omitted from the new Order and Ministry of Food licences for such trading are therefore no longer required. It is also made clear in the new Order that mixtures of any of the scheduled vegetable or marine oils with any other oil are controlled by the Order.

Britain has purchased some 200,000 tons of vegetable oils, including 100,000 tons of linseed oil, for shipment from the Argentine in 1947, the Minister of Food announced at a Press conference this week. Not all the purchases will be for this country. However, as under the International Emergency Food Council allocations they must be shared with North America and other countries. The vegetable oil purchases are reported to include also 50,000 tons of sunflower oil, 10,000 tons of cottonseed oil, 5000 tons of rapeseed oil, 5000 tons of groundnut oil and 20,000 tons of miscellaneous oils.

Overseas News Items

Exports of sulphur from Sicily are expected to be resumed soon.

Exports of Norwegian aluminium to the Soviet Union are to be resumed at an early date.

Potash output in France increased from 57,438 tons in September to 62,683 tons in October.

The Chilean Nitrate Corporation has announced a new price for crude iodine f 1.50 dollars per lb., compared with 1.28½ dollars previously.

Argentinian producers of quebracho extract regard the imposition of an export duty, expected to be five per cent on the f.o.b. prices, as a foregone conclusion.

Large deposits of lignite found in the March and Thaya Valley of South Moravia have been estimated by experts at between 85,000,000-102,000,000 tons.

Korean raw materials available for export include agar-agar, fluorite, cyanide, graphite, manganese, mica, molybdenum talc and tungsten.

Japan exported to the United States in the first eight months of this year the following raw materials: agar-agar 60,835 lb.; antimony, 1,686,744 lb.; lead, 23,705,113 lb.; tin, 11,890,067 lb.

The U.S.A. domestic supply of lead—both newly mined and scrap—next year will fall 255,000 tons below estimated needs, according to Mr. Felix E. Wormser, secretary of the Lead Industries Association. Total use next year is estimated at 1,055,000 tons.

Japan's production of dyestuffs increased in August last, reaching 39 per cent. of the country's minimum requirements. This increase resulted from a larger coal allocation, which made it possible to manufacture more intermediate products.

The Kola Peninsula, situated between the White Sea and the Barens Sea, is to be industrialised according to *Izvestia*. In particular, the exploitation of metal, especially nickel deposits, is to be taken in hand.

The Skoda works at Pilsen, now nationalised, has received from Beunos Aires an order for an alcohol distillery with a daily production of 250 tons. Construction is expected to take two years. It is stated that Skoda met strong competition from the U.S.A., Sweden and Switzerland.

Japanese pyrethrum may be released for export at an early date.

Holland is to export chemicals to Sweden under a new trade agreement concluded in The Hague recently.

The United States exported to the Soviet Union chemicals worth 1,126,000 dollars and imported chemicals valued at 112,000 dollars in the first six months of this year.

Russia is to export cellulose to be used in the Belgian rayon industry. France, too, is stated to have made inquiries for supplies of cellulose from the U.S.S.R.

About 20,000 tons of fertilisers, bought by the Taiwan (Formosa) Provincial Relief Committee from the United States, is to be shipped by March, 1947.

Dyestuffs will be exported by Greater Hesse for Sweden under the terms of a trade agreement recently signed between the two.

The Government of Kashmir has established an industrial chemical research laboratory. The Alembic Chemical Works, Boroda, has been carrying out experiments in the manufacture of alkaloids.

A new plant for the manufacture of soda ash and borax will be erected at Rona, Cal., by the American Potash and Chemical Corporation, at a cost of $4,500,000. It will have an estimated annual output of 60,000 tons of soda ash and 30,000 tons of borax.

A soya bean product called "Driscoy" is now being produced in the U.S.A. on a commercial basis. It is claimed that it may be used as a substitute for linseed oil, with which it is said to compare favourably as regards drying speed. Its brushing and flowing properties are described as excellent.

Since price control on meat has been removed in the United States, the price of raw pancreas, used in the manufacture of insulin, has risen from 16c. to 34c., against a pre-war price of 8c. to 12c. As a result the price of insulin has gone up by about 50 per cent.

The so-called consolidated licensing procedure, under which U.S. exporters need submit only one licence application quarterly for shipments to "Group K" countries (which include all countries except Rumania, Bulgaria, Hungary, Spain and its possessions) has been extended by the U.S. Office of International Trade to include a wide range of chemical products.

Chemical and Allied Stocks and Shares

STOCK markets were helped by the end of the U.S. coal strike. The return to account dealings, following the war-time "cash only" expedient, tended to increase the volume of business in the industrial sections. British Funds, however, were fractionally easier where changed. Home rails kept fairly steady, although various junior stocks remained below their "take-over" levels, and the continued absence of any official statement regarding the rate of interest on the proposed new British Transport stock affected sentiment. Many holders of home rails appeared to be adopting a waiting attitude in the hope that opposition to transport nationalisation will force the Government to amend its schemes

In common with shares of companies outside the Government's nationalisation plans, chemical and kindred shares have tended to attract increased attention, prices showing moderate gains as a result. Future benefits to be derived from the abolition of E.P.T. also helped sentiment. It is known that sums which would otherwise have gone in E.P.T. will have to be placed to equipment and similar reserves; but on the other hand, it is felt that where earnings have been maintained, there is a strong case for a less conservative dividend policy than during the war years. Imperial Chemical at 44s. 6d. showed firmness, Lever & Unilever were 52s. 9d., and B. Laporte 100s. 7½d., while British Drug Houses, which were favoured on forthcoming benefits from E.P.T. abolition rose to 60s. Accompanied by higher dividend hopes and continued talk that the shares may be "split" into a lower denomination, International Combustion rose further to £10¼. There was demand for shares associated with building, Associated Cements rising to 69s. 6d. British Plaster Board to 32s. 9d. and Allied Ironfounders to 62s. 6d., while paint shares have been helped by the bigger Lewis Berger dividend (26 per cent., against 19 per cent.). Lewis Berger were £7⅞. Pinchin Johnson rose to 50s. 3d., Goodlass Wall were 30s. 1½d., and International Paint £6¾.

Iron and steels continued to be helped by the industry's "reprieve" from nationalisation, Stewarts & Lloyds strengthening to 55s. 6d., Whitehead Iron to 98s. 3d., and John Summers to 32s. 6d., while Dorman Long further rallied to 27s. 9d. Colliery shares have been steady, with coal distributors favoured, Wm. Cory rising to 108s. 9d., and Lambert Bros. to 87s. 6d. Textiles strengthened on the Government proposal to pay for part of the industry's new equipment requirements. Calico Printers were 24s. 3d., Fine Spinners 26s. 10½d., and Bradford Dyers rose to 25s. 9d. In other directions, Amalgamated Metal firmed up to 21s. and British Match shares rose further to 54s. on higher dividend possibilities. British Ropes 2s. 6d. shares have been favoured up to 12s. 4½d. Morgan Crucible were firm at 57s. 3d., and Stevenson & Howell at 31s. 3d. There were dealings up to the higher level of 27s. 3d. in Burt Boulton & Haywood. Electric equipment shares were favoured, but later eased, Associated Electrical being 73s. 6d. and General Electric 103s. 6d., sentiment coming under the influence of the forthcoming fuel "cut" for industry. Disappointment with the unchanged dividend lowered Turner & Newall to 89s. 6d.

Boots Drug have been firm at 63s. 9d. Beechams deferred were 28s., but Griffiths Hughes eased to 62s. 6d., Borax Consolidated deferred remained at 48s. 3d. In other directions, British Glues & Chemicals 4s. ordinary were good at 17s. 3d., with the participating preference shares also higher at 18s. 6d. De La Rue were £13¼ and British Industrial Plastics 7s. 7½d. Oils became less firm with Shell 94s. 4½d. Anglo-Iranian 98s. 9d. and Attock Oil at 39s. 4½d. reflected the easier tendency in Indian shares.

Company News

Trading profit of £78,701 for the year ended June 30 was earned by the **Sulphide Corporation,** as compared with £75,087. The preference dividend is 5 per cent.

The Council of the London Stock Exchange has granted **Lever Bros & Unilever N.V.** permission to deal in 236,100 4 per cent redeemable cumulative preference sub-shares of Fl.12 each.

The nominal capital of **Ashe Laboratories Ltd.,** 120/2, Victoria Street, London, S.W.1. has been increased beyond the registered capital of £40,000 by £20,000 in £1 6 per cent preference shares.

The nominal capital of **L.P.C. Lead Pigments & Chemicals, Ltd.,** 7, Gracechurch Street, London, E.C.3 has been increased beyond the registered capital of £2000 by £48,000 in £1 ordinary shares.

Net profit amounting to £25,612, as compared with £24,168 for the previous year, is reported by **British Benzole and Coal Distillation, Ltd.,** for the year ended ended October 31. The ordinary dividend and bonus remain at 15 per cent.

British Tar Products, Ltd., report profit of £32,444 for the year ended September 30, as against £36,736 for the previous year. The final dividend of 19 per cent makes 22 per cent for the year, equal to 25 per cent on existing capital as reduced last year, when the dividend paid was 11 per cent.

Prices of British Chemical Products

A VERY firm price position characterises most sections of the London industrial chemicals market and in some directions higher quotations would not be unexpected. There is little change to report in general trading conditions, which are influenced by the availability of supplies. A fair amount of replacement buying has been put through. Acetone, acetic acid and citric acid are in strong request and an upward movement in values in these materials might result from the increased cost of molasses. In the coal tar products market nearly all items are well booked and spot transactions are difficult to negotiate.

MANCHESTER.—Although prices on the Manchester chemical market during the past week have shown little actual movement, the undertone remains very strong in practically all sections, and advances in a number of directions in the near future would occasion little surprise. There is a sustained demand for textile chemicals of all descriptions from the cotton, woollen and rayon industries, and other leading industrial users of heavy products are specifying freely. Fresh home and shipping inquiries have been of fair volume during the week. Activity continues in almost all of the tar products and steady pressure upon distillers for actual deliveries is reported.

GLASGOW.—The last month of the year has produced active conditions in the Scottish heavy chemical market, with contracts coming up for renewal and considerable business being done in all classes of heavy chemicals previous to the beginning of 1947, when general changes in price may be expected. The export market was again exceedingly busy and orders have been secured for caustic soda, magnesium sulphate, zinc chloride, agricultural salt, ground limestone, zinc oxide, textile chemicals, bleaching powder, copper sulphate and sulphuric acid. Shipping space is again becoming difficult and delivery periods are difficult to forecast. Prices are again very firm, with an indication of freight increases in the New Year.

Price Changes

Rises: Carbon tetrachloride, copper sulphate, toluol, zinc oxide (all Manchester).

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton, £47 10s.; 80% pure, 1 ton, £49 10s.; commercial glacial, 1 ton, £59; delivered buyers' premises in returnable barrels: £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r. MANCHESTER: £16 to £16 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER: £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—MANCHESTER: £40 per ton d/d.

Ammonium Carbonate.—£42 per ton d/d in 5 cwt. casks. MANCHESTER: Powder, £43 d/d.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf Fine white 98%, £19 10s. per ton. See also Salammoniac.

Ammonium Persulphate.—MANCHESTER: £5 per cwt. d/d.

Antimony Oxide.—£120 to £123 per ton.

Arsenic.—Per ton, 99/100%, £38 6s. 3d. to £41 6s. 3d., according to quality, ex-store.

Barium Carbonate.—Precip., 4-ton lots, £19 per ton d/d; 2-ton lots, £19 5s. per ton. bag packing, ex works.

Barium Chloride.—98/100% prime white crystals, 4-ton lots, £19 10s. per ton, bag packing, ex works.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £18 15s. per ton d/d; 2-ton lots, £19 10s. per ton.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax.—Per ton for ton lots, in free 1-cwt. bags, carriage paid: Commercial, granulated, £30; crystals, £31; powdered, £31 10s.; extra fine powder, £32 10s. B.P., crystals, £39; powdered, £39 10s.; extra fine, £40 10s. Borax glass, per ton in free 1-cwt. waterproof paper-lined bags, for home trade only, carriage paid: lump, £77; powdered, £78.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granulated, £52; crystals, £53; powdered, £54; extra fine powder, £56. B.P., crystals, £61; powder, £62; extra fine, £64.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£22 per ton, ex wharf. Granulated, £27 per ton.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5⅝d. per lb.

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Carbonate.—MANCHESTER: £8 15s. per cwt. d/d.

Copper Oxide.—Black, powdered, about 1s. 4½d. per lb.

Copper Sulphate.—£37 10s. per ton f.o.b., less 2%, in 2 cwt. bags.

Cream of Tartar.—100 per cent., per cwt., from £12 14s. 6d. for 10-cwt. lots to £14 1s. per cwt. lots, d/d. Less than 1 cwt., 2s. 5½d. to 2s. 7½d. per lb. d/d.

Formaldehyde.—£27 to £28 10s. per ton in casks, according to quantity, d/d. MANCHESTER: £28.

Formic Acid.—85%, £54 per ton for ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1260 s.g., in tins, £4 16s. 6d. to £5 10s. 6d. per cwt., according to quantity; in drums, £4 2s. 6d. to £4 16s. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—11d. per lb. d/d, carboys extra and returnable.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d per lb., according to quantity.

Lactic Acid.—Pale tech., £60 per ton; dark tech.. £53 per ton ex works; barrels returnable.

Lead Acetate.—White, 70s. to 75s. per cwt., according to quantity.

Lead Nitrate.—About £70 per ton d/d in casks. MANCHESTER: £70 to £72.

Lead, Red.—Basic prices per ton: Genuine dry red lead, £71; orange lead, £83. Ground in oil: Red, £92; orange, £104. Ready-mixed lead paint: Red. £99; orange, £111.

Lead, White.—Dry English, in 8-cwt. casks, £83 per ton. Ground in oil, English, in 5-cwt. casks, £102 per ton.

Litharge.—£68 10s. to £71 per ton, according to quantity.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £36 per ton.

Magnesium Chloride.—Solid (ex wharf), £27 10s. per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., for 2-cwt lots, 9s. 1d.; smaller quantities dearer.

Mercurous Chloride.—10s. 1d. to 10s. 7d. per lb., according to quantity.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 3s. per gal.; pyridinised 64° O.P. 100 gal., 3s. 1d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£100 to £105 per ton in ton lots packed in free 5-cwt. casks. MANCHESTER: £5 to £5 2s. 6d. per cwt

Paraffin Wax.—Nominal.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £76 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate. — Crystals and granular, 7½d. per lb.; ground, 8½d. per lb., for not less than 6 cwt.; 1-cwt. lots, ½d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £57 per ton for 5-ton lots, £57 10s. per ton for 1 to 5-ton lots, all ex store; hydrated, £51 per ton for 5-ton lots, £51 10s. for 1 to 5-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 8½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8d. per lb.; technical, £7 14s. 3d. to £8 6s. 3d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Salicylic Acid.—MANCHESTER: 1s. 9d. to 2s. 1d. per lb. d/d.

Soda, Caustic. — Solid 76/77%; spot, £16 7s. 6d. per ton d/d.

Sodium Acetate.—£42 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 6½d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite. — Powder, 60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£45 to £47 per ton.

Sodium Hyposulphite.—Pea crystals 19s. per cwt. (ton lots); commercial, 1-ton lots, £17 per ton carriage paid. Packing free.

Sodium Iodide.—B.P., for not less than 28 lb., 10s. 2d. per lb.

Sodium Metaphosphate (Calgon).—11d. per lb. d/d.

Sodium Metasilicate.—£16 10s. per ton, d/d U.K. in ton lots.

Sodium Nitrite.—£23 per ton.

Sodium Percarbonate.—12½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £25 per ton d/d for ton lots. Tri-sodium, £27 10s. per ton d/d for ton lots (crystalline).

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salt).—£5 5s. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. MANCHESTER: £4 12s. 6d. to £4 15s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot, £20 2s. 6d. per ton, d/d, in drums; crystals, 30/32%, £13 7s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £14 5s. to £16 10s., according to fineness.

Sulphuric Acid.—168° Tw., £6 2s. 8d. to £7 2s. 8d. per ton; 140° Tw., arsenic-free, £4 11s. per ton; 140° Tw., arsenious, £4 3s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—Per cwt., for 10 cwt. or more, £15 8s.; 5 to 10 cwt., £15 9s. 6d.; 2 to 5 cwt., £15 11s.; 1 to 2 cwt., £15 13s. Less than 1 cwt., 3s. 1d. to 3s. 3d. per lb. d/d, according to quantity.

Tin Oxide.—1 cwt. lots d/d £25 10s.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d; white seal, £58 10s.; green seal, £57 10s.; red seal, £56.

Zinc Sulphate.—Tech., £25 per ton, carriage paid.

Rubber Chemicals

Antimony Sulphide.—Golden, 1s. 8½d. to 2s. 7½d. per lb. Crimson, 2s. 7½d. to 3s. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 3s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£37 to £41 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£48 to £51 per ton, according to quantity.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 10 5/16d to 1s. 5¾d. per lb.; dark, 10½d. to 1s. per lb.

Lithopone.—30%, £28 2s. 6d. per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Phosphate.—Imported material, 11% nitrogen, 48% phosphoric acid, per ton in 6-ton lots, d/d farmer's nearest station, in December £20 4s. 6d., rising by 2s. 6d. per ton per month to March, 1947.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, in December £9 18s. 6d., rising by 1s. 6d., per ton per month to March, 1947.

Calcium Cyanamide.—Nominal; supplies very scanty.

Concentrated Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. No. 1 grade, where available, £14 18s. 6d.

"Nitro Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £17 5s. per ton; granulated, over 98%, £16 per ton.

Coal Tar Products

Benzol.—Per gal. ex works: 90's, 2s. 6d.; pure, 2s. 8½d.; nitration grade, 2s. 10½d

Carbolic Acid.—Crystals, 11½d. per lb. Crude, 60's, 4s. 3d. MANCHESTER: Crystals, 9½d. to 11½d. per lb., d/d; crude, 4s. 8d., naked, at works.

Creosote.—Home trade, 5¾d. to 8d. per gal., according to quality, f.o.r. maker's works. MANCHESTER, 6½d. to 9¾d. per gal.

Cresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. MANCHESTER: Pale, 99/100%, 4s. 4d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £7 2s. 6d. to £10 per ton, according to m.p.; hot-pressed, £11 10s. to £12 10s. per ton, in bulk ex works; purified crystals, £25 15s. to £28 15s per ton. Controlled prices.

Pitch.—Medium, soft, home trade, 75s. per ton f.o.r. suppliers' works; export trade, 120s. per ton f.o.b. suppliers' port. MANCHESTER: 77s. 6d. f.o.r.

Pyridine.—90/140°, 18s. per gal.; 90/160°, 14s. MANCHESTER: 14s. 6d. to 18s. 6d. per gal.

Toluol.—Pure, 3s. 2½d. per gal.; 90's, 2s. 4d. per gal. MANCHESTER: Pure, 3s. 2½d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 3½d. to 3s. 6d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £15 per ton; grey, £22.

Methyl Acetone.—40/50%, £56 to £60 per ton.

Wood Creosote.—Unrefined, from 3s. 6d. per gal., according to boiling range.

Wood Naphtha.—Miscible, 4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. to 6s. 6d. per gal.

Wood Tar.—£6 to £10 per ton.

Intermediates and Dyes (Prices Nominal)

***m*-Cresol 98/100%.**—Nominal.

***o*-Cresol 30/31° C.**—Nominal.

***p*-Cresol 34/35° C.**—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb, 66/68° C., 1s.

***p*-Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

***o*-Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

***p*-Toluidine.**—2s. 2d. per lb., in casks.

***m*-Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON.—December 11. For the period ending December 28 (February 1, 1947, for refined oils), per ton, naked, ex mill, works or refinery, and subject to additional charges according to package; LINSEED OIL, crude, £135. RAPESEED OIL, crude, £91. COTTONSEED OIL, crude, £80; washed, £84. COCONUT OIL, crude, £80; refined deodorised, £84; refined hardened deodorised, £88. PALM KERNEL OIL, crude, £79; refined deodorised, £84; refined hardened deodorised, £88. PALM OIL (per ton c.i.f.), in returnable casks, £58 10s.; in drums on loan, £58; in bulk, £57. GROUNDNUT OIL, crude, £56 10s.; refined deodorised, £86; refined hardened deodorised, £90. WHALE OIL, refined hardened, 42 deg., £89; refined hardened, 46/48 deg., £90. ACID OILS. Groundnut, £55; soya, £53; coconut and palm-kernel, £58 10s. ROSIN: Wood, 32s. to 45s.; gum, 44s. to 54s. per cwt., ex store, according to grade. TURPENTINE, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Preparation of oximes.—N.V. Algemeene Kunstzijde Unie. 33847.

Gas turbine engine fuel oils.—Anglo-Iranian Oil Co., Ltd., M. O. Scott, and J. W. Withers. 33903.

Gas turbine engine fuel oils.—Anglo-Iranian Oil Co., Ltd., M. O. Scott, J. G. Withers, and S. F. Birch. 33902.

Gas turbine engine fuel oils.—Anglo-Iranian Oil Co., Ltd., J. G. Withers, and M. O. Scott. 33901.

Deriving gas black from meltane.—R. von Becker. 34008.

Coating compositions.—L. Berger & Sons, Ltd., L. E. Wakeford, D. H. Hewitt, and F. Armitage. 33604.

Styrene copolymers.—L. Berger & Sons, Ltd., L. E. Wakeford, D. H. Hewitt, and F. Armitage. 33605.

Organic compounds.—W. Bridge, and I.C.I., Ltd. 33669.

Surface treatment of aluminium.—British Aluminium Co., Ltd., and A. N. D. Pullen. 33751.

Synthetic resins, etc.—British Celanese, Ltd. 33601.

Resinous compositions.—British Resin Products, Ltd., and J. H. W. Turner. 34081.

Polysiloxane resins.—British Thomson-Houston Co., Ltd. 33963-34125.

Purification of benzene hexachloride.—L. J. Burrage, and I.C.I., Ltd. 34094.

Casein hardening.—BX Plastics, Ltd., P. G. T. Hand, and S. H. Pinner. 33867.

Thioglycolic acids.—G. Carpeni, and P. Souckay. 34102-3.

Nitrogen trichloride.—N.V. de Korenschoof. 33545.

Surface coatings.—Diffusion Alloys, Ltd., R. L. Samuel, and N. A. Lockington, 33858.

Ethylene oxide recovery.—Distillers Co., Ltd., and F. J. Wilkins. 33715.

Maleic anhydride.—Distillers Co., Ltd., T. Bewley, R. N. Lacey, and F. E. Salt. 33714.

Polymers.—J. G. N. Drewitt, and J. Lincoln. 33600.

Polymers of ethylene.—E.I. Du Pont de Nemours & Co. 33914.

Calcium phosphate products.—Emion Holdings, Ltd., and C. S. Townsend. 34097.

Treatment of effluent water.—A. J. Evans, W. A. Jones. 34015.

Castor oil extraction.—C. E. Every. (Sherwin-Williams Co.) 33626.

Vegetable oil extraction.—C. E. Every. (Sherwin-Williams Co.) 33627.

Moulding plastics.—C. F. J Forssell. 33826.

Vinyl sulphonic acids.—General Aniline & Film Corporation. 34156.

Vinyl ether polymers.—General Aniline & Film Corporation. 34157.

Vinyl ethers.—General Aniline & Film Corporation. 34160.

Electrodeposition of metal.—Glacier Metal Co., Ltd., and W. H. Tait. 33828.

Polymer lattices.—B. F. Goodrich Co. 33575.

Electrolytic treatment of aluminium.—C. H. R. Gower, and E. Windsor Bowen. 33740.

Penicillin.—Heyden Chemical Corporation. 33853-4.

Filling of Leather.—D. B. Kelly, J. H. Sharphouse, and I.C.I., Ltd. 34093.

Treatment of oils.—Z. M. Leppert, and F. W. Ochynski. 34133.

Sodium hydroxide solutions.—N.V. Koninklijke Nederlandsche Zoutindustrie. 33976.

Ferrous alloys.—Nitralloy Corporation. 34164.

Chemical process.—J. E. Nyrop. 33573.

Recovery of salts.—Permutit Co.. Ltd.. and W. G. Prescott. 33843.

Insecticides.—C. R. Pla. 33929.

Heat treatment of Metals.—Ranalax, Ltd., and A. Peet. 33683.

Catalytic preparations.—Refiners, Ltd., T. Scott, and G. Baddeley. 33831.

Alloy steels.—L. Rotherham, C. Stokes, and C. Sykes. 34174.

Surface active ingredients.—Sharples Chemicals, Inc. 33688.

Polyvinyl derivatives.—Soc Rhodiaceta. 33721.

Magnesia insulation.—A. H. Stevens (Johns-Manville Corporation.) 33939.

Heterocyclic sulphur compounds —Texaco Development Corporation. 33811.

Pyridine derivatives.—Therapeutic Research Corporation of Great Britain, Ltd., and V. Petrow. 34162.

Pyridine derivatives.—Therapeutic Research Corporation of Great Britain, Ltd., V. Petrow, and E. L. Rewald. 34161.

Recovery of fluorine compounds.—C. L. Walsh, B. A. Adams, H. R. Bott, and A.S.P. Chemical Co., Ltd. 33722.

Complete Specifications Open to Public Inspection

Preparing solutions of gases.—Central-laboratorium A/B. July 18, 1944. 28335/46

Melting of high temperature refractory materials.—Babcock & Wilcox Co. Dec. 19, 1944. 32801/45.

Manufacture of organic compounds.—British Celanese, Ltd. May 19, 1945. 15043/46.

Manufacture of ferromagnetic metal or alloy powder.—Communication Engineering Proprietary, Ltd. May 19, 1945. 12136/46.

Soda lime gas absorbents.—Dewey & Almy Chemical Co. May 18, 1945. 14877-8/46.

Polymerisation catalysts.—E.I. Du Pont de Nemours & Co. Oct. 20, 1942. 17245/43.

Laminated materials.—E.I. Du Pont de Nemours & Co. Oct. 25, 1943. 20722/44.

Dyeing.—E.I. Du Pont de Nemours & Co. May 4, 1945. 13494/46.

Manufacture of polyazo dyestuffs.—J. R. Geigy A.G. May 16, 1945. 14671/46.

Preparation of granular polyvinyl ethers.—General Aniline & Film Corporation. May 18, 1945. 12075/46.

Adhesive compositions.—B. F. Goodrich Co. Dec. 27, 1943. 30517/46.

Concentrated synthetic latex.—B. F. Goodrich Co. June 18. 1943. 30647/46.

Polymers of monomeric organic compounds.—B. F. Goodrich Co. March 13. 1944. 30648/46.

Nuclear chlorination of aromatic carboxylic acids.—B. F. Goodrich Co. Nov. 11, 1944. 30649/46.

1, 1, 2-Trichlorethane and process of preparing the same.—B. F. Goodrich Co. Aug. 28, 1943. 30780/46.

Preparation of halomaleate copolymers.—B. F. Goodrich Co. Jan. 27, 1944. 30781/46.

Preparation of colouring matter and other products.—J. de Granville, and M. H. R. de Granville. May 18, 1945. 26045/46.

Increasing speeds of reaction in an heterogenous medium.—L'Oreal S.A. Oct. 10, 1942. 31226/46.

Process for soap purifying.—L.Oreal S.A. July 31, 1943. 31227/46.

Treatment of cellulosic textiles.—Mathieson Alkali Works. May 16, 1945. 6008/46.

Agglomeration process for industrial products, such as coal or wood.—G. Melin. May 19, 1945. 13876/46.

Complete Specifications Accepted

Method and apparatus for the purification of gas.—G. L. Simpson. Feb. 9. 1944. 582,045.

Manufacture of sulphonated ethers containing at least one aralkyl residue.—Soc. of Chemical Industry in Basle. Jan 9, 1942. 581,985.

Manufacture of vinyl-chloroacetylenes.—Soc. of Chemical Industry in Basle. June 1, 1943. 582,060.

Interpolymers of iso-olefines with tertiary triolefins.—Standard Oil Development Co. Sept. 5, 1941. 581,979.

Magnetic means for the hardness testing of metals.—Standard Telephones & Cables, Ltd., and H. R. Stocks. April 30, 1940. 581,964.

Process of coating fibrous materials and the products produced.—Sylvania Industrial Corporation. Aug. 7, 1942. 581,928.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

BOUVERIE HOUSE, 154 FLEET STREET, LONDON, E.C.4

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1434. December 21, 1946 Annual Subscription 21s. Overseas 26s.

Coke Ovens Under Nationalisation

WITH the nationalisation of the coal mines has come the nationalisation of the coke ovens owned by collieries; thus a part of the chemical industry has been nationalised. The first step along the path of socialisation has been taken, and he would be a bold man who would predict how far that path will lead us.

The direction in which things are moving was disclosed by Mr. Shinwell and Lord Hyndley at the annual luncheon of the Coke Oven Managers' Association in October. The coking industry has never taken its full place as a part of the chemical industry of the country because it has been under the ownership of those whose interests and responsibilities lie primarily in the field of coal mining and not to a great extent in that of chemicals. There are men on most colliery boards who have wide interests, not infrequently embracing the chemical industry, but they cannot for the most part describe themselves as chemists or chemical engineers. There have been outstanding exceptions to the generalisation we are making, but generally it is true to say that coke ovens have been regarded as means for making the silken purse of metallurgical coke from the sow's ear of whatever coal the colliery could not dispose of to better advantage. The first major concern of the newly-nationalised coke-oven managers, therefore, was that in the new dispensation they should be separated from the colliery. That objective has been secured. Mr. Shinwell had no hesitation in declaring that the collieries would require modernisation and that colliery managers would have far too much to do to look after their own work to meddle with by-product coking. We applaud that decision. The operation of coal carbonisation is a part of the chemical industry and produces products that are used as raw materials by other branches of that industry. Even blast-furnace coke is in effect a chemical since it is used partly as a reducing agent in the blast furnace.

The second concern of the Coke Oven Managers' Association has been that the by-product coke-oven process shall be regarded as kin to the gas industry and to the chemical industry. The new President, Mr. G. A. Phillipson, has suggested that the coke and gas produced in "off-season" working should be converted into chemical products. He said in his presidential address, "During the summer months gas surplus to domestic requirements could be delivered to synthesis plant and from this supply, augmented by coke, the synthesis process operated; concur-

> **NOTICE TO READERS**
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> **Owing to greatly increased printing and publishing costs, the annual subscription to THE CHEMICAL AGE will be raised to 26/- per annum, as from January 1, 1947. This is the first increase since THE CHEMICAL AGE was founded over 26 years ago.**

iently, during this period surplus coke could be stored. When the winter demand re-appears and the surplus gas is no longer available, then the synthesis plant will be turned over to operate on stock coke. Such a programme might take some years to bring to fruition, but benefits will be derived as each section of the development programme is completed." Mr. Phillipson has put forward a bold scheme which would link the coke ovens more directly with the chemical industry. He suggests that the coke ovens be directly linked with the gas industry and that gas grids be built to enable pithead carbonisation plants and gasworks to co-operate to bring gas to everyone. Through these gas grids, coal gas would be supplied to chemical works for the production of chemicals from the constituents of the gas. Those works could be for the production of ammonia, methanol and similar products now being produced already at one works in this country and many works on the Continent; or they could be Fischer-Tropsch synthesis plants. The reference to coke makes us believe that he had the Fischer-Tropsch process in mind. Mr. Phillipson was connected with the Fischer-Tropsch process in its earlier commercial developments, and is no doubt well informed as to its potentialities, but the findings of the BIOS team which were discussed in these columns last week suggest that the time is not yet ripe for commercial developments on these lines.

The need for the future is for research work of a commercialised character in the direction of expanding the coking industry. The iron and steel industry has sponsored most of the organised research work undertaken by coke producers; that is natural since that industry is dependent upon the quality of coke for the efficient production of the iron it manufactures. It may be ungracious to suggest that it has been a major disaster for by-product coking and for the chemical side of that industry that the research work should have been concentrated on coke as a reagent for the blast furnace. The chemical development of by-product coking has been sadly neglected. This is a direction in which not even the builders of coke ovens, usually foremost in research, have shown any active interest. Mr. Phillipson sees that clearly for he says: "The coal processing and carbonising industry should be placed under a National Carbonising Board, on lines more or less similar to the German Ruhr system, where the preparation of coal and all chemical processing is under the direction of expert technicians trained in the industry."

There is to-day a shortage of trained men for almost every industry and the coking industry is not immune from this difficulty. The demand in Mr. Phillipson's words is that there should be more training facilities: "At the moment efforts in this direction are not sufficiently co-ordinated, and a concentration on agreed courses could be made, particularly specialising in the training of physicists and organic chemists which are the two most important branches necessary to develop to the utmost the scientific treatment of coal." Once more, the emphasis is placed upon scientific treatment and the linkage of coking with other chemical industries.

These, then, are the aspirations of those who constitute the works management of coking plants. Where do they lead? The intention of the National Coal Board appears to be to place the coking industry under a centralised Directorate acting under the Board. The Coal Board has Sir Charles Ellis as its scientific director, and as we understand Mr. Shinwell's remarks, Sir Charles is expected to develop the chemical side of coal utilisation. We imagine that the coke ovens will at a later stage be removed from the jurisdiction of the Board and placed with the gas industry under a National Carbonising Board. Certainly the Coal Board should not seek to control the gas industry; we have heard whispers that such is its intention. The great question-mark is what chemical products are needed that can be produced from coal, and in what quantities. These questions lead to the same conclusion as we reached last week, namely, that some expert inquiry is needed to determine the answers to them. We suggest that the A.B.C.M. and the Government departments concerned should set up such an inquiry.

Known as "Good-rite," a rubber-like chemical which is basically polyethylene polysulphide is stated to be in commercial production by the B. F. Goodrich Co., of America, for spraying on trees and plants and sealing them from attack by insects and fungi. On application with normal spraying equipment, a microscopic rubbery web is formed on fruit and trees and it stretches with growth. It is claimed that no taste or odour remains on the fruit if applications are discontinued six weeks before harvest.

NOTES AND COMMENTS

WE extend to our readers the time-honoured and sincere wish of a very Happy Christmas and a Prosperous New Year. At this, the closing of a year of peace, the chemical industry can view with pride the past year's achievements and look with quiet confidence to the coming year. Our industry can congratulate itself on work well done. It is one of the few whose output has gone up by leaps and bounds. Its goods find a ready market overseas. And, if the stability of the labour-management relations is a criterion, we can safely assert that the industry is a happy one. No large-scale labour disputes—or even small ones to our knowledge—have marred relations between workers and employers. Everybody in the industry has a keen interest, as well as a financial stake, in its present prosperity. And that prosperity and friendly relations which were so marked a feature of 1946, will, we hope and think, continue through 1947.

A USEFUL SURVEY

A REPORT on a survey of scientific man-power in the Manchester area gives interesting and valuable information especially to would-be entrants into the chemical industry. The survey was made in an effort to assess the increase to be expected in the number of technically-trained men to be employed by industry in the coming years, compared with the years before the war. It was carried out by means of a questionnaire sent by the Manchester Joint Research Council to a representative cross-section of the industrial firms in the Greater Manchester area. From the answers it would seem that although the number of chemical firms employing graduates has increased only by 21 per cent, the number of graduates employed in the whole chemical industry has increased by 100 per cent; while the total increase in the number of employed graduates in all industries was 80 per cent. The chemical industry appears, therefore, to be absorbing a proportionately greater number of university-trained men than other industries. The firms were also asked if they were in favour of graduates having a period of post-graduate research at the university before recruitment. Over half the chemical firms were in favour of this, compared with an average of 38 per cent in all industries. Among the industries offering openings on the scientific research and development, technical and managerial sides, the chemical industry was high on the list. No less than 56 per cent offered openings to graduates in a scientific capacity (research and development), 83 per cent to graduates in a technical capacity and 70 per cent to graduates in a managerial capacity. These figures will be very heartening to the young men in the universities. They show that not only are there openings in all fields of industry, and especially the chemical industry, but that in over 60 per cent of the firms offering employment to graduates the higher executive posts are open to the scientist who shows himself to be competent and adaptable. Young graduates will also be wise to take note of the marked preference which most firms—especially the larger ones—have for men with research experience and methods. (The smaller firms laid greater stress on technical training for graduate staff.) This survey, the first of its kind, should not only give a lead and encouragement to university men, but should also provide the universities themselves with a foundation for the assessment of the extra calls to be expected from industry for graduates in the future years, and the degree of training called for by the various sections of industry. Manchester is to be congratulated on this pioneer work.

A.B.C.M. DIRECTORY

THE good things of pre-war days are sadly slow in coming back to us. At least one good thing, however, has made its welcome re-appearance and that is a new edition of *British Chemicals and their Manufacturers*, which is the official directory of the Association of British Chemical Manufacturers and a reference book without which no chemist's library is complete. This is the first revised edition since 1939, for during the war years the Association were prohibited by Government regulations from bringing out an up-to-date edition, since, of course, the information it contains concerning British chemical factories

might well have got into enemy hands. The new edition is now able to present up-to-date information regarding the manufacture of all types of chemicals, including heavy, fine and pure. In earlier years the Association brought out a second publication, *Directory of British Fine Chemicals*, but both this and the 1939 edition of *British Chemicals and their Manufacturers* are now superseded. The new edition incorporates the subject matter of both and will thus undoubtedly be of double service to users, for, while its format is smaller than that of the 1939 edition, considerably more information has been compactly embodied in it than in the two original directories. One omission entailed in the restricted size is that of the equivalent names in various foreign languages of the different chemicals listed. Unfortunately, the Association were able to acquire only half the paper which they could usefully have employed. On the grounds that the directory was not published during the war, the paper controllers declined to grant a bigger allocation—typical Government department logic, since it was by Government order that there was no publication during the war. However, there is abundant value in the new edition, despite its restricted size, and we are sure our readers will be prompt to secure a copy, which they can obtain *gratis* if they write to the Association at 166 Piccadilly, London, W.1, indicating their *bona fides*.

THE TRANSPORT BILL

THE Association of British Chemical Manufacturers, the British Iron and Steel Federation, and the Fertilisers Manufacturers' Association are among the influential trade organisations which have joined, albeit indirectly, in the fight against the nationalisation proposals of the Government as contained in the Transport Bill. These organisations are members of the Traders' Dock and Harbour Co-ordinating Committee, which has issued a declaration viewing " with gravest concern " the Governments proposals as they relate to port facilties. This is one of the latest developments in the struggle against the Bill and is indicative of the growing opposition. Earlier, there came a Stock Exchange memorandum to the Government, in which the Council stressed that Stock Exchange quotations cannot form a fair and equitable or a rational basis for compensation. This was followed by a statement from the Association of Investment Trusts and the Investment Protection Committee of the British Insurance Association, demanding an unbiased judicial inquiry. The opposition has been yet further strengthened by the formation of a powerful liaison committee of transport and industry. Organisations represented on the committee will be kept informed of steps it is proposed to take against the nationalisation of transport and the committee will consider the best means of joint action to secure a public inquiry before the Bill becomes law. Mass meetings of railway stockholders have also strongly protested against the Bill. It was in this atmosphere of indignation that the Bill came before the House of Commons for its second reading at the beginning of this week.

MICROBIOLOGY

A POINTER to the increasing interest in microbiology is the announcement that the newly-founded Society for General Microbiology, the president of which is Sir Alexander Fleming, of penicillin fame, is to issue its own journal. With the title of *Journal of General Microbiology*, the first number will appear in January and in the first place will consist of three numbers a year. Its purpose is to publish original research work in the field of general microbiology and to promote the advancement of microbiology by providing means whereby the work in various specialised fields can be gathered together for the benefit of all workers in microbiology. The Society was founded for the study of bacteria, micro-fungi, microscopic algæ, protozoa and viruses in their various biological activities and, more particularly, the fundamental aspects of the study of these forms, including their structure and development, physiology and nutrition, genetics and cytology, systematics, ecology, antibiotic activity and reaction to chemotherapeutic agents. The editorial board of the journal will consist of Dr. B. C. J. G. Knight, and Dr. A. A. Miles, editors, and Dr. G. C. Ainsworth, Professor W. B. Brierley, Dr. T. Gibson, Dr. A. T. R. Mattick, Dr. Kenneth Smith, Dr. A. W. Stableforth, and Dr. D. D. Woods as associate editors. It will be the policy of the editors to publish not only papers having an immediate bearing on general microbiology, but also papers on specialised aspects of the various subjects.

PROGRESS IN HYDROGENATION OF COAL AND TAR*

by KENNETH GORDON, C.B.E., M.C.†

THE Billingham coal hydrogenation plant was designed originally to make 100,000 tons a year of petrol by the hydrogenation of Durham coal. It was decided to complete the vapour-phase section of the plant first, and to start this with creosote oil, so that when the coal-hydrogenation section was ready, operations would not be delayed by difficulties in the subsequent vapour-phase section. This involved the installation of a distillation unit for re-running the creosote oil and additional storage tanks. Before the erection of the plant was completed it was decided that more hydrogen could be made available than had originally been expected, and the manufacture of 42,000 tons a year of petrol from creosote oil was made a permanent addition to the original scheme.

Very soon after the start of plant operations it was apparent that, while creosote could be hydrogenated on the large scale with the efficiency predicted by semi-technical experiments, detailed plant modifications would be necessary for a satisfactory output from coal. Purchases of creosote were therefore increased in 1936 to raise petrol production from this raw material to 75,000 tons a year.

The practical difficulties in the hydrogenation of coal were gradually overcome, and from the end of 1936 to the beginning of the war, coal hydrogenation continued without mechanical trouble. As a measure of the reliability of coal hydrogenation, the longest uninterrupted run obtained on one of the units of the coal hydrogenation plant at Billingham was seven months; the average run in the years 1937 to 1939 was 2½ months.

Effect of Coal Costs

During this period increases in the price of coal, and consequently in the cost of hydrogen, had an adverse effect on petrol costs, which was most marked in the case of coal hydrogenation. Consequently, despite the establishment of the coal process, creosote continued to be treated in much greater quantities than were anticipated in the 1934 plan. This is shown in Table I, which gives the relative amounts of petrol made from coal and creosote year by year.

The petrol was made to comply with various market requirements and was finished to specifications laid down by the oil marketing companies—Shell Mex and B.P. and the Anglo-American Oil Company —who undertook the distribution of our products. Commercial grade, No. 1 premium—both straight and leaded—and 87 octane number aviation fuel comprised the pre-war production. During the war period, 87 octane number fuel, pool petrol, and base spirit for 100 octane number fuel were made.

TABLE I.
OUTPUT OF PETROL AT BILLINGHAM, 1935 TO 1945.

Year.	Petrol produced from coal. Tons.	Petrol produced from creosote. Tons.
1935	11,000	58,000
1936	35,000	76,000
1937	44,000	74,000
1938	52,000	91,000
1939	28,000	120,000
1940	—	148,000
1941	—	111,000
1942	—	92,000
1943	—	76,000
1944	—	106,000
1945	—	97,000

In 1939 it was decided to rearrange the plant to increase the amount of petrol made from creosote to 180,000 tons a year, with a corresponding reduction in the petrol made from coal to 20,000 tons a year. This gave an overall increase in the output of the plant, and left coal hydrogenation operating on a sufficiently large scale for continued study of the process.

The original plant was built with two coal hydrogenation stalls, one heavy-oil hydrogenation stall, and two vapour-phase hydrogenation stalls. The alterations intended were to modify the plant to give us two combined units for heavy-oil and coal hydrogenation, two units for the first stage of vapour-phase hydrogenation, which we call "saturation," and two for the second stage, which we call "splitting." At the same time additional units were to be installed for the distillation of creosote oil, and of the increased quantity of vapour-phase product which would be made. Owing to the incidence of the war, this is the only part of the scheme completed.

It was also decided early in 1939 to install a plant for the manufacture of iso-octane on a scale of 10,000 tons a year by the dehydrogenation of butane to butenes, followed by polymerisation and hydrogenation. The completion of this plant was also delayed by the war, but it was operated for the first time in October, 1940. This was the first plant installed in the world for this process.

Questions arising from the operation of the plant under wartime conditions had re-

* From a paper presented to the Institute of Fuel in London on December 9.

† Joint Managing Director, Billingham Division, Imperial Chemical Industries.

ceived much study before September, 1939. The hydrogenation of coal under such conditions appeared to be extremely difficult. It was a fundamental part of defence that the pressure should be released from high-pressure plants during air raid periods so that the secondary damage arising from fires and explosions which would be caused by escapes of gas could be avoided. While most high-pressure units can be put out of action in a few minutes, a coal-hydrogenation unit requires a much longer time, since it is necessary, if heavy coke formation is to be avoided, to displace the coal contained in the reaction vessels with oil before the release of pressure. It was therefore decided that coal hydrogenation would be difficult, if not impossible, during the time where there were frequent air raids, and coal hydrogenation was therefore discontinued at the outbreak of war.

Increased Demand

It was not long before the increase in the price of coal meant that a resumption of this part of the process would be quite uneconomic, and the shortage of coal meant that the raw material was not in any case available. There was also an increased demand for hydrogen for ammonia manufacture to give the maximum output of fertilisers for home food production. Coal hydrogenation was not therefore resumed, and there does not appear to be any immediate prospect of its being restarted Creosote hydrogenation continued throughout. In the early days of the war the only product was 87 octane number aviation fuel. For a period, pool motor spirit was made, but from May, 1942, the sole output of the plant has been 100 octane number aviation fuel components.

From 1943 onwards the Billingham hydrogenation plant was run in conjunction with the oil hydrogenation plant at Heysam, and the Shell Company's iso-octane plant at Stanlow, to produce the maximum possible output of aviation fuel. In 1944 one of the hydrogenation units at Billingham was converted to the manufacture of butyl benzene, to which the name of " Victane " was given, for use as an aviation spirit component. This material was made by the alkylation of benzene with the butylenes obtained from the iso-octane units. Its manufacture was thus to a large extent alternative to the production of iso-octane. This is not the place to give the details of this combined effort in aviation spirit manufacture. The total output was at a rate of 500,000 tons a year; a substantial and a timely contribution to the great quantities required. Billingham provided nearly a quarter of the total.

A plant was installed in 1937 for the recovery of phenol, cresol and xylenols from the hydrogenation product. The crude material from coal hydrogenation is very rich in these minerals, as is indicated in Table II. The recovery of butane, and its sale as bottled gas, have been previously referred to. A propane recovery plant was added in March, 1940, and during the war there have been considerable developments in the use of this product as a replacement for acetylene for metal cutting.

TABLE II.

YIELDS OF PHENOL AND CRESOL FROM COAL.

Yields from 100 tons

	Yields from 100 tons a.m.f. coal.*	Per cent by weight of total liquids produced.
	Tons.	
Phenol	1.2	2.2
Cresol	3.5	6.5

* a.m.f.=weight of coal on an ash and moisture free basis.

During the years before the war, many schemes were prepared for other coal hydrogenation plants. In spite of the degree of protection afforded and guaranteed, no sufficiently attractive scheme could be evolved. If any development had taken place it would have been along the same general lines as that at Billingham, except that the methane-steam process would have been relied on to a greater extent for the manufacture of hydrogen, and that a somewhat higher operating pressure would have been employed in place of the Billingham standard of 250 atmospheres.

Aviation Spirit

Very considerable attention was given to the production of aviation spirit, since the base spirit made by hydrogenation has a very high octane number. It was decided that coal hydrogenation would be too expensive as a source of aviation fuel, and in view of the shortage of coal which arose during the war we can regard this decision as fortunate. Creosote derived from coal, and gas oil from petroleum, were the alternative raw materials. Petroleum oil had the advantage that it was available in unlimited quantities, and that its treatment requires only half the quantity of hydrogen needed for creosote oil. Both the capital and running costs of manufacture of aviation spirit from petroleum oil were therefore considerably lower than from creosote, and this factor was held to offset the disadvantages of reliance on imported material, and the somewhat lower quality of the petrol produced.

A safeguard existed in that a plant designed for the hydrogenation of gas oil could without extensive alterations be used for the hydrogenation of creosote oil, although its output would then be reduced to about half, because of the greater quantity of hydrogen needed. As a result of these investigations, Imperial Chemical Industries,

Ltd., the Shell Refining & Marketing Co., and Trinidad Leaseholds, Ltd., acting together as a joint company known as "Trimpell, Ltd.," built and operated for the Air Ministry, later the Ministry of Aircraft Production, a plant at Heysham for the manufacture of 300,000 tons a year of petrol by the hydrogenation of gas oil and 50,000 tons a year of iso-octane made from butane arising from hydrogenation. This plant was completely successful in operation, and its full description must be the subject of another paper.

A very full account of the development of the hydrogenation process in Germany is in preparation by the teams visiting them just before and after the end of the war.*

TABLE III.

CAPACITY OF GERMAN HYDROGENATION PLANTS.

Plant	Main raw materials.	Capacity for production of liquid oil products.	Actual maximum output rate achieved.
		T./yr.	T./yr.
Scholven ..	Bituminous coal	220,000	240,000
Gelsenberg ...	,, ,,	400,000	435,000
Blechhammer	,, ,,	425,000	65,000
Politz - Stettin	,, ,, pitch, tar and heavy petroleum residues	700,000	750,000
Welheim ...	Pitch and tar...	130,000	145,000
Lutzkendorf...	Tar and petroleum residues	50,000	12,000
Wesseling ...	Rhine brown coal	200,000	280,000
Leuna ...	Middle German brown coal and brown coal tar	620,000	640,000
Bohlen ..	Brown coal tar	250,000	275,000
Magdeburg ...	,, ,, ,,	250,000	275,000
Zeitz ...	,, ,, ,,	250,000	250,000
Brux ...	,, ,, ,,	400,000	360,000

From the technical point of view there is only one departure from the process as operated in this country at the outbreak of war. The pressure of the latest coal-hydrogenation units was raised to 700 atmospheres. This pressure was not employed so much to give an increased yield as to avoid the rather complicated catalytic conditions which are necessary for operation at pressures in the range of 200 to 300 atmospheres. These conditions, which were discovered in the laboratories at Billingham, are the use of tin as the catalyst combined with active chlorine in the form of ammonium chloride to give a definitely acid condition during the reaction. This involves the neutralisation of the vapours before condensation takes place, with a suspension of alkali in oil, to avoid the serious corrosion in cooling equipment which would otherwise occur. At higher pressures much the same yields can be obtained with a simple iron catalyst. A combination of acid catalytic conditions with higher pressures is impracticable because it is impossible to avoid corrosive conditions.

The striking thing about the German developments was, not their quality, but their quantity. Table III gives a list of the German hydrogenation plants. Some small coal hydrogenation plants have been built in France and in Japan, but there is no other big-scale development.

The hydrogen required for hydrogenation at Billingham is still made by the method described on a previous occasion. There have as yet been no developments for the manufacture of hydrogen employing bituminous coal directly as the raw material. In Germany there was considerable work on new forms of water-gas generators, but most of this was directed to the employment of low-grade fuels which would not be available for gasification by standard methods.

A combination of coke ovens and water-gas plant is neither very efficient thermally, nor is it inexpensive in operation, because of the intermittent nature of both operations. Table IV gives an indication of the thermal efficiency of the processes for making hydrogen in the form of "catalysed gas" from coal; in this connection thermal efficiency is defined as the ratio of the net heat of combustion of useful products to net heat of combustion of raw materials.

TABLE IV.

(ALL QUANTITIES PER 1000 M^3 OF HYDROGEN).

Material	Quantity Kg. or m^3.	Net calorific value K.cal./Kg. or m^3.	Thermal efficiency of process per cent.	Remarks
Coal	765	7600	85	Includes by-products, surplus gas and breeze.
Coke	550	6900		
Water gas	1100	2380	69	Includes water gas with $>$ 2 per cent. nitrogen purged each cycle. Excludes steam recovery.
			93	
Catalysed gas	1550	1570		Assumes complete conversion of CO
Overall coke hydrogen ...	—	—	55	

The most striking development in the manufacture of hydrogen has been the so-called "methane-steam" process. Methane —or for that matter any other saturated

* See *Report on the Petroleum and Synthetic Oil Industry in Germany*, submitted to the Minister of Fuel and Power by the Committee on German Oil Production Plants (to be published shortly). There is also a shorter account published in a paper by R. Holroyd read to the Junior Institution of Engineers, Incorporated, in May of this year

TABLE V.

OPERATING CONDITIONS—METHANE-STEAM PLANT.

Gas	Rate m^3/hour	Calorific value T. cal./1000 m^3	Analysis (per cent.) H^2	CO_2	CO	N_2	H/C's	O_2	H_2O
Hydrocarbon gas	3,150	11,718	46.0	—	—	4.8	48.2	—	—
Reformed gas	17,350	—	74.8	11.3	11.8	1.0	1.3	—	—
Catalysed gas	18,600	2,022	77.1	17.7	3.1	1.0	1.1	—	—
Flue gas	22,200	—	—	12.5	—	66.8	—	4.6	16.1
" H " water gas—Fuel ...	5,800	2,400	52.5	6.3	38.7	1.5	0.4	0.2	—

Material	Usage or make
HP steam	10.1 te.*/hr.
LP steam	5.0 te./hr.
	m^3/hr.
Hydrocarbon gas	3,150
Reformed gas + steam	24,700
Reformed gas	17,350
Catalysed gas	18,600
Catalysed gas	18,600
Flue gas	22,200
Flue gas	22,200
Flue gas	22,200

Temperature point	Temperature °C
Inlet interchanger	170
Exit interchanger	398
Inlet interchanger	110
Exit interchanger	385
Exit interchanger	400
Exit furnace	680
Inlet CO converter	380
Exit CO converter	443
Inlet gas cooling tower	205
Exit furnace	942
Exit waste-heat boiler...	431
Stack	189

$$\text{Thermal efficiency} = \frac{\text{Calorific value catalysed gas made}}{\text{Calorific values H/C gas used and fuel gas used}} \times 100$$

$= 73.8$ per cent.

* te. = metric tonne of 2,204 lb.

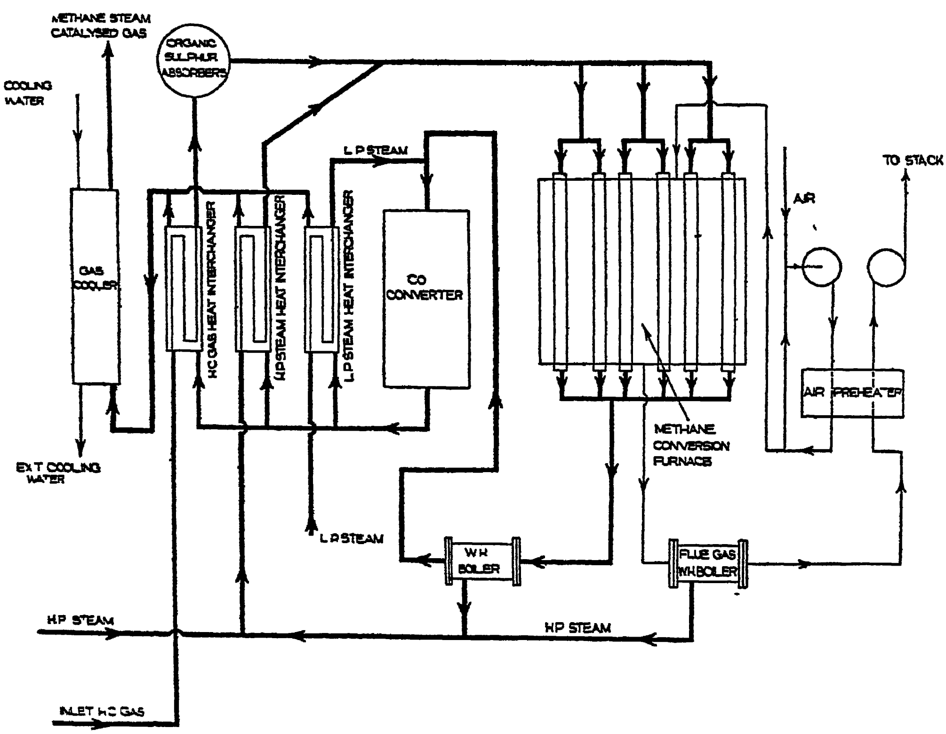


Fig. 1. Methane-steam Plant.

hydrocarbon gas—is treated with steam in the presence of a nickel catalyst to give almost complete conversion to hydrogen and carbon monoxide. By the addition of a second reaction vessel at a lower temperature, with an iron-chromium catalyst, the CO in the "reformed" gas can be used for the generation of a further supply of hydrogen.

The first commercial plants built for this process were at Bayway and Baton Rouge, and serve oil hydrogenation units built by the Standard Oil Company of New Jersey. With their design as a basis, considerable experimental work was carried out at Billingham, including the operation of a full-size reaction tube. As a result it was decided that a unit with 66 standard 6-in. tubes, which for some reason appears to be universally employed as a standard unit, had a capacity of 12,000 to 15,000 cu. m. per hour—nearly three times that originally contemplated. The unit at Billingham took advantage of this higher output and also had added to it very complete heat-recovery arrangements. A similar, but improved, unit was built at Heysham, and this was the prototype for several others which were built in Canada and in the United States.

Fig. 1 is a flow diagram of the Heysham methane-steam unit, and is self-explanatory. Table V gives the operating conditions for this unit. The process is very simple and easy in operation. It requires the minimum amount of attention and repairs and has a high thermal efficiency. The overall thermal efficiency shown in Table V, it will be noted, is 73.8 per cent.

Since the hydrogenation operations at Billingham have been restricted to the vapour-phase units, the methane-steam units have been closed down. This is because the vapour-phase process produces for practical purposes only propane and butane, which are both fully utilised for other purposes, leaving no raw material for the methane-steam units. It is only when liquid-phase hydrogenation, with its relatively high proportion of methane and ethane, is employed, or when there is an extraneous source of hydrocarbon gases, such as natural gas, that

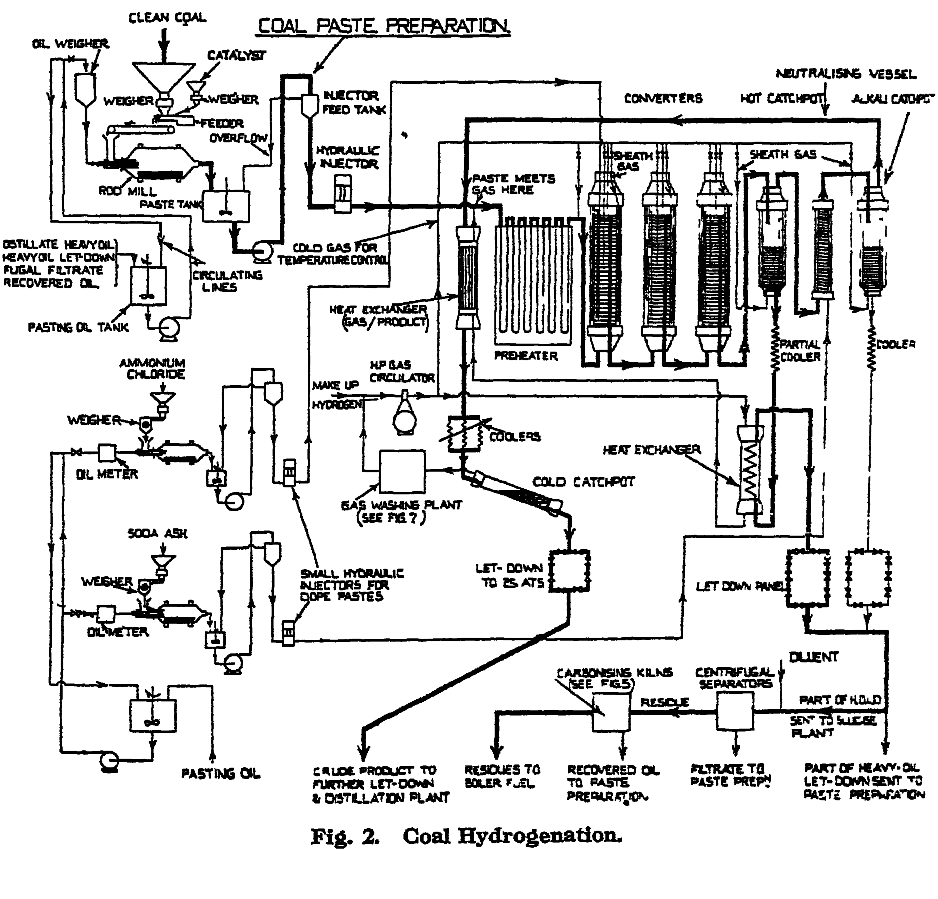


Fig. 2. Coal Hydrogenation.

the methane-steam process is required in conjunction with hydrogenation.

Fig. 2 is a flowsheet of the coal hydrogenation stalls as originally arranged at Billingham. The coal paste made as described on a previous occasion is injected by means of hydraulically operated injectors. It will be seen from the diagram that subsidiary injectors are required for the injection of a paste of ammonium chloride in oil, and for the paste of soda in oil which is required for the subsequent neutralisation of the vapours. This neutralisation step requires a second hot catchpot and let-down panel.

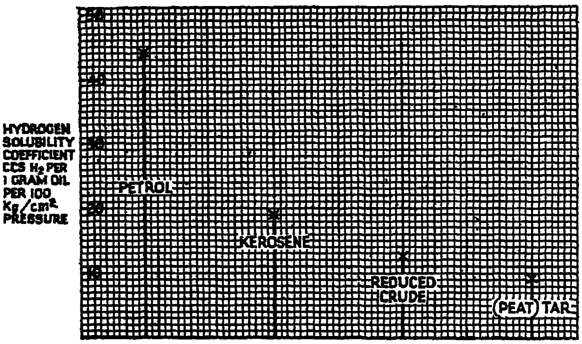


Fig. 3. Solubility of hydrogen in different oils at 240°C.

When the first unit was operated it soon became apparent that the degree of hydrogenation effected was less than at first anticipated by experimental results in semi-technical plants. Part of the difficulty was traced to the relatively high proportion of the cross section of the converter occupied by the hydrogen passing through the coal oil burden contained in the converter. This difficulty was largely overcome by reducing the number of converters per stall from three to two, with corresponding diminution in throughput. A device subsequently employed was the provision of four converters per stall, but with two parallel paths through the heat exchangers, preheater and converters. Even with these arrangements it must be recorded that the yields are still not so good as could be obtained in semi-technical plants, and the reason for this discrepancy is still partly unexplained.

One contributing factor is believed to concern the catalytic effect of surfaces. It is certain that the walls of small experimental converters display a highly catalytic effect after they have been operated for some time, and in big-scale converters exposed surface to reaction volume is, of course, much less. Reduction of the surface effect in large-scale operation would be expected to increase the yield of unreacted coal and to increase the make of high molecular weight intermediate hydrogenation products or asphalts.

A second difference between semi-technical and large-scale operation is that in the former it is impossible to avoid entirely some accidental purge of these asphaltic products, as, for example, in the form of samples of crude product required for analysis. The reduced catalytic effect of surface, combined with a small asphalt purge, has the result that in large-scale operation the equilibrium asphalt content of pasting oil, and, consequently, of the reacting burden in the converters, is higher than is the case in semi-technical work.

The hydrogenation of coal clearly takes place at the interface between the coal and the oil in which it is suspended and, to a relatively minor extent, between the coal and the gaseous phase directly. The governing factor is therefore the solubility of hydrogen in oil, which, as shown in Fig. 3, decreases with increasing complexity of the oil. Incidentally, in this connection it is interesting to note that the main reason for hydrogenation being at all possible is that solubility of hydrogen in all oils is increased by increase of temperature, as illustrated in Fig. 4. Usually gas solubilities show the reverse relationship.

It will be appreciated from the foregoing that the introduction of any factor which reduces, even to a slight extent, the degree of hydrogenation sets up a "snowball" effect by reducing the concentration of reacting hydrogen, and it is therefore not surprising that coal hydrogenation is one of the most difficult reactions from the standpoint of correlation of semi-technical and large-scale results.

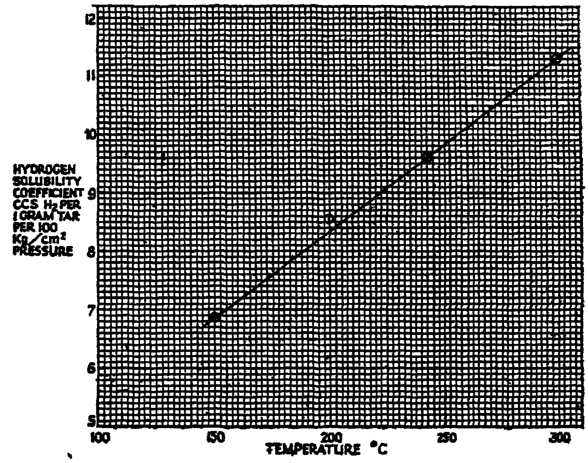
It was our original intention to carry out the coal hydrogenation reaction in two liquid-phase stages, the first producing petrol, middle oil and distillate heavy oil, and the second converting the heavy oil into a middle oil and petrol under optimum reaction conditions. On the large scale it was found that employment of the relatively mild conditions required for production of excess heavy oil in the first stage led to an excessive build-up of asphalt in the recycle oils, and it was thefore necessary to revert to

single-stage conditions—that is to say, conditions in which the production of heavy oil in a single-stage treatment was little more than that required for making up the coal paste.

The treatment of the heavy oil let-down, which contains the unconverted coal, the asphalt and the ash, gave not unexpectedly considerable difficulty at first. The original method adopted was as follows: Part of the heavy oil let-down was recycled and used as pasting oil. The balance was first mixed with asphalt-free heavy oil obtained from the cold catchpot product and treated to a continuous centrifugal process, the object of which was to dissolve part of the asphalts, leaving a concentrate consisting of about 45 per cent of ash and unconverted coal. This residue was treated for oil recovery in an apparatus devised by the I.G. and known as a "Kugelofen." In this plant, which is illustrated in Fig. 5, the residue is treated in a revolving kiln with superheated steam. The kiln is heated externally and is partly filled with iron balls which break up the carbonised material as it is formed on the walls of the kiln. These units, as might have been expected, require high maintenance and cannot be said to have been very successful. In particular, it was found that they would only operate satisfactorily with a feed containing a low ratio of asphalt to solids; otherwise they were rapidly choked with a plastic intermediate product of carbonisation. The use of the kilns thus provided only a very small purge of asphaltic material, and therefore accentuated the general asphalt troubles which have already been discussed.

In the end it was decided to do away with the dilution, fugalling and kiln carbonisation process, and to employ a much simpler procedure for the purge of ash and unconverted coal. The appropriate quantity of

Fig. 4. Solubility of hydrogen in peat tar.



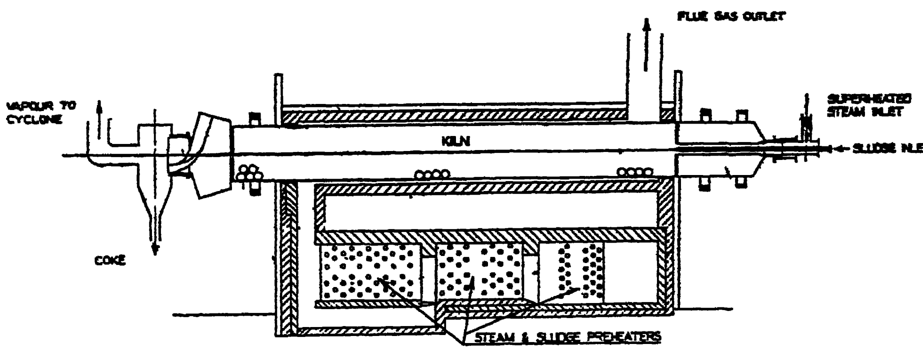


Fig. 5. "Kugelofen" for treatment of hydrogen plant residues.

heavy oil let-down was fed direct to the flash distillation plant illustrated in Fig. 6. In this plant the residue is heated and flashed into a chamber from which the vaporised oil is withdrawn, and passes into a cooler while the unvaporised residue falls into a trough of water, in which it coagulates into a material which it is possible to burn. Although the oil recovery which is possible by this simplified process is not nearly so great as is theoretically possible with the earlier method, the process is much more practical and economical in operation.

Table VI gives the operating conditions for coal hydrogenation. The overall position is represented in Table VII.

Taking 98 per cent and 95 per cent respectively as the yields of final petrol from coal petrol and middle oil, the final petrol yield is 51.5 per cent on a.m.f. coal. This figure could be increased by working up hydrocarbon gases to petrol. These figures only deal with the coal used for hydrogenation itself, and exclude that required for production of hydrogen, power and steam. The process is so interlinked at Billingham with other activities that no direct figure is available. At a separate hypothetical factory, the figure depends upon the methods used—for example, the extent to which the methane-steam process is depended upon for hydrogen manufacture. Five to six tons per ton of petrol is a fair figure.

In the original layout at Billingham, one stall with three converters was reserved for the hydrogenation of surplus heavy oil from coal hydrogenation. It was also used for the treatment of the heavy oil fraction of creosote oil. Whilst coal hydrogenation was in progress it was found preferable in practice to use creosote heavy oil as part of the oil required for preparing the coal paste, and to use as the feed to this liquid-phase stall a corresponding quantity of coal stall heavy oil product. The reason for this was that the creosote heavy oil contained a small amount of alkali which had been left in the oil as a result of the extraction of tar acids. Alkali has a deleterious effect on hydrogenation.

The stall for heavy-oil hydrogenation was identical with that used for coal hydrogenation, except that the arrangements for injection of ammonium chloride and for neutralising the hydrochloric acid in the vapour were not provided. An addition was that a hot circulating pump was included to recirculate the oil from the hot catchpot back to the converer. Fig. 7 shows the flow diagram of the stall, and Table VIII gives the average operating conditions for creosote oil; coal heavy oil gives very similar results.

The catalysts used for this reaction were tin oxalate and iodine. The concentration of the latter had to be kept low both on account of cost and in order to avoid corrosion troubles. Enough carbon tetrachloride to effect neutralisation of traces of alkali was also added. With this restricted

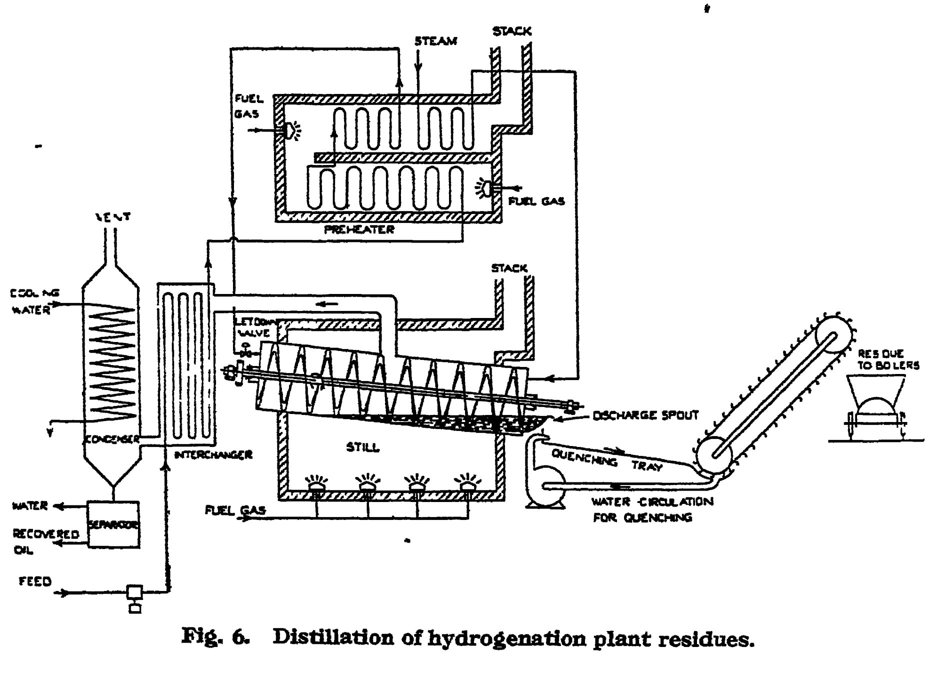


Fig. 6. Distillation of hydrogenation plant residues.

TABLE VI.

OPERATING CONDITIONS FOR COAL HYDROGENATION.

Coal content of paste :	47 per cent by weight
Consumption of tin oxalate catalyst :	0.02 per cent by weight on paste feed
Consumption of NH_4Cl :	0.2 per cent by weight on paste feed
Paste feed rate :	0.5 tons per m³ reaction volume per hour
Coal (a.m.f.) feed rate :	0.215 tons per m³ reaction volume per hour
Average converter temperature :	465 °C
Average converter pressure :	265 atmospheres
Average hydrogen partial pressure :	189 atmospheres
Hydrogen content of inlet gas :	84 per cent by volume
Hydrogen content of exit gas :	76 per cent by volume

FLOWSHEET DATA

(all figures in tons)

	a.m.f. coal	Ash	Water, NH_3, H_2S, HCl	Unconverted coal	Heavy oil over 335°C	Middle oil 180-335°C	Petrol 0-180°C	Hydrocarbon gas	Nitrogen	Hydrogen	Unaccounted for loss	Total
Ingoing materials												
Coal	100.0	3.3	5.4	—	—	—	—	—	—	—	—	108.7
Pasting oil for coal	—	6.3	—	11.6	100.4	4.0	—	—	—	—	—	122.3
Ammonium chloride and sodium carbonate	—	0.4	0.3	—	—	—	—	—	—	—	—	0.7
Pasting oil for NH_4Cl and Na_2CO_3 ...	—	0.3	—	0.5	3.0	—	—	—	—	—	—	3.8
Recycle hydrogen	—	—	—	—	—	—	—	22.4	47.8	32.8	—	103.0
Hydrogen make-up	—	—	—	—	—	—	—	0.4	4.7	9.3*	—	14.4
TOTAL ...	100.0	10.3	5.7	12.1	103.4	4.0	—	22.8	52.5	42.1	—	352.9
Primary products												
Recycle hydrogen	—	—	—	—	—	—	—	22.4	47.8	32.8	—	103.0
Gas purge via gas washing ...	—	—	—	—	—	—	—	19.1	3.5	0.7	—	23.3
Gas purge from hot catchpot let-down ...	—	—	—	—	—	—	—	0.9	0.4	0.1	—	1.4
Gas purge from cold catchpot let-down ...	—	—	—	—	—	—	—	3.3	0.8	0.2	—	4.3
Heavy oil (hot) let-down ...	—	9.6	—	17.6	57.8	—	—	—	—	—	—	85.0
Second hot let-down	—	0.7	—	0.5	10.8	—	—	—	—	—	—	12.0
Cold catchpot product ...	—	—	13.4	—	41.3	46.6	11.4	5.1	—	—	—	117.8
Loss	—	—	—	—	—	—	—	—	—	—	6.1	6.1
TOTAL ...	—	10.3	13.4	18.1	109.9	46.6	11.4	50.8	52.5	33.8	6.1	352.9
Net makes from 100 t. a.m.f. coal	—	—	7.7	6.0	6.5	42.6	11.4	28.0	—	8.3	6.1	—
Final products												
Recycle hydrogen	—	—	—	—	—	—	—	22.4	47.8	32.8	—	103.0
Lean gas ...	—	—	—	—	—	—	—	14.1	3.2	0.7	—	18.0
Rich gas ...	—	—	—	—	—	—	—	11.5	1.0	0.2	—	12.7
Heavy oil let-down (to paste)	—	6.5	—	11.8	38.9	—	—	—	—	—	—	57.2
Filtrate to paste	—	0.1	—	0.3	9.5	—	—	—	—	—	—	9.9
Recovered oil ex sludge (to paste)	—	—	—	—	13.7	—	—	—	—	—	—	13.7
Heavy oil ex cold catchpot (to paste)	—	—	—	—	41.3	—	—	—	—	—	—	41.3
Sludge residues	—	3.7	—	6.0	5.9	—	—	—	—	—	—	15.6
Petrol	—	—	—	—	—	—	11.3	—	—	—	—	11.3
Middle oil ...	—	—	—	—	—	46.4	—	—	—	—	—	46.4
Liquor	—	—	13.4	—	—	—	—	—	—	—	—	13.4
Loss	—	—	—	—	0.6	0.2	0.1	2.8	0.5	0.1	6.1	10.4
TOTAL ...	—	10.3	13.4	18.1	109.9	46.6	11.4	50.8	52.5	33.8	6.1	352.9
Net yield of final products from 100 t. a.m.f. coal ...						42.4	11.3	25.2				

* This is a weight proportion: the hydrogen used was 96 per cent. purity by volume.

use of iodine the rate of hydrogenation was not as great as could be desired. Improved results could be obtained by introduction of anti-corrosion and iodine recovery measures when the concentration of this catalyst could be increased. Alternatively it should be possible to find conditions under which active catalysts of the tungsten sulphide type might be used for this reaction. Considerable work has been carried out at Billingham on the possible utilisation of active catalysts, and it is concluded that a necessary condition is the complete removal of asphalt and solids from the feed oil. The only stall we have operated under such liquid-phase conditions was at Heysham, where the saturation stage of what would normally be vapour-phase hydrogenation was in practice carried out in the liquid phase. This will be referred to later.

TABLE VII.

OVERALL YIELDS FROM COAL.

IN		
Coal— a.m.f	100.0	
Ash and moisture	8.7	
Hydrogen.	9.3	
Catalyst material, etc.	0.7	
	118.7	
OUT		
Petrol	11.3	
Middle oil	42.4	
Total oil :		53.7
Hydrocarbon gases		25.2
Sludge residues		15.6
Liquor		13.4
Hydrogen purge to fuel		0.9
Net loss		9.9
		118.7

(To be continued)

Italy's leading cement producer, the Italcementi-Fabbriche Riunite Cemento of Bergamo, has recently absorbed the Cementi Artificiali of Genova. In the course of this transaction, the share capital of the Italcementi will be increased from 1805 to 800 million lire.

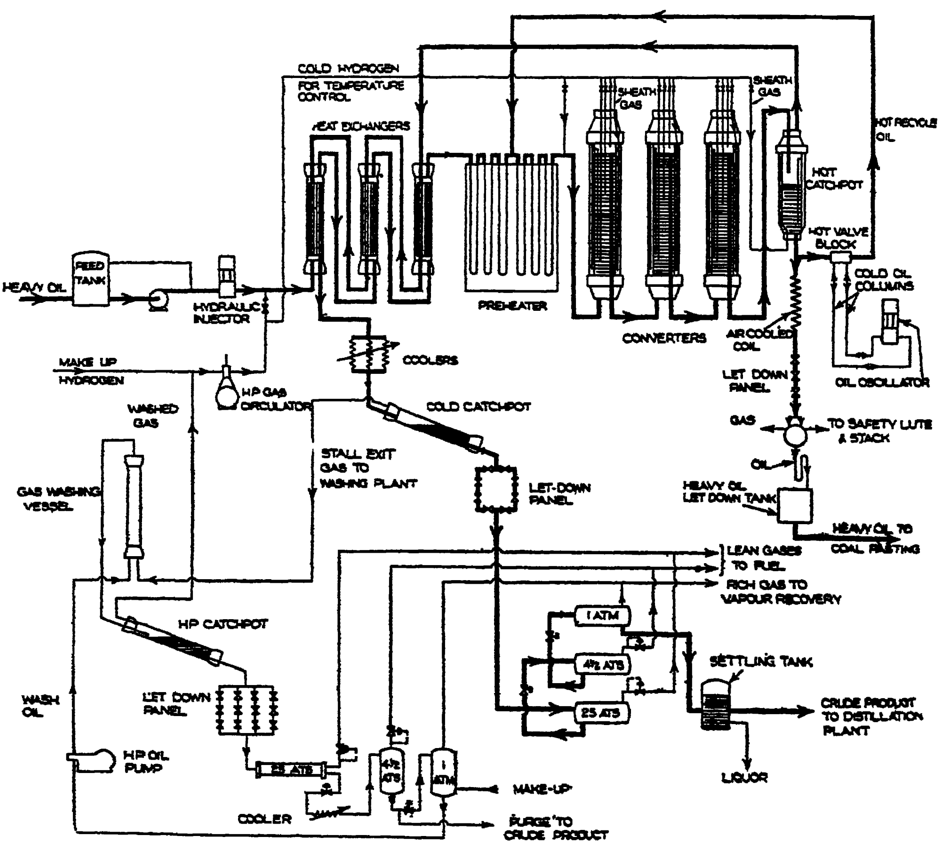


Fig. 7. Liquid-phase hydrogenation of heavy oil.

Modern Water Gas Plant

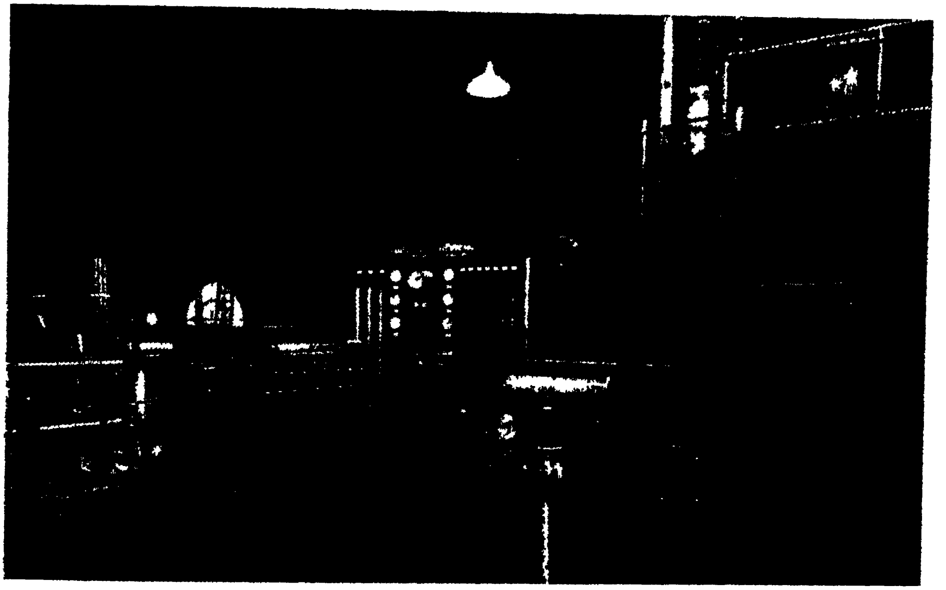
Interesting New Developments

IT is many years since the Power-Gas Corporation, Ltd., Parkfield Works, Stockton-on-Tees, built one of the first water gas plants in the world, with a mechanical self-clinkering grate and automatic ash extraction. It is probable that this innovation, and that of automatic operation, have done more than any other to advance the water gas process from its earlier stages of development to its present state of efficiency, both chemically and mechanically.

The company has now designed and constructed what is claimed to be the most modern type of gas plant, the P.G. Automatically Operated Mechanical Carburetted Water Gas Plant. This type of plant was recently installed by them at the South Suburban Gas Company's works at Lower Sydenham, S.E. In Leaflet CWG846, just issued by the Power-Gas Corporation, Ltd., this new and up-to-date plant is fully described and illustrated in all its interesting processes. The carburetted water gas plant is especially suited to cope with "peak" loads. It can be set into operation with extreme speed, not more than an interval of hours being necessary before full production can be achieved from cold. The gas make can be regulated as required, down to a fraction of rated output, while maintaining uninterrupted production.

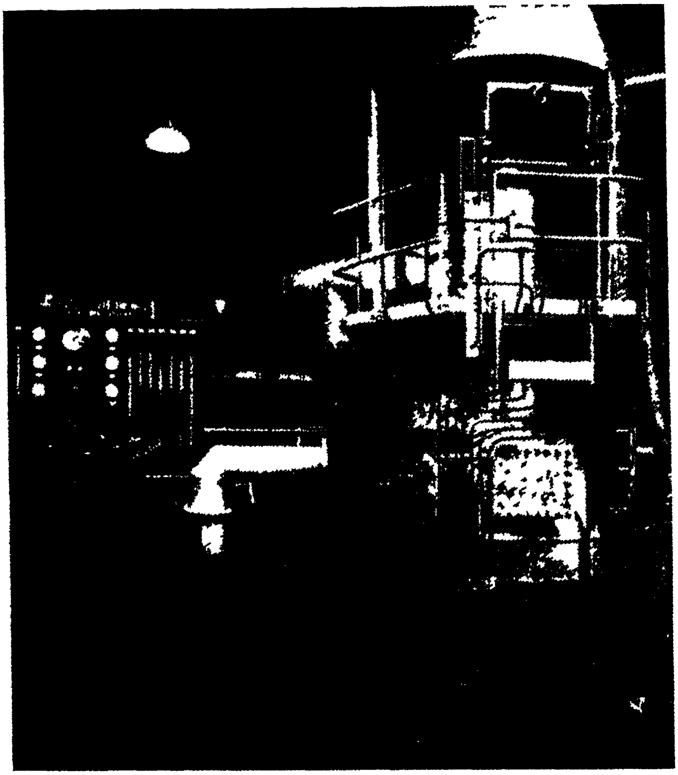
On the other hand, the water gas plant can be set to "stand-by" and maintained ready for immediate re-operation. This obviously is of much importance in a town's gas industry, upon which "peak" load demands often attain abnormal levels. The variation in calorific value which can be achieved at will with carburetted water gas, and the high flame temperature of the gas, are further qualities of value for all industrial heat applications.

Essential features of the modern carburetted water gas plant is the generator in which the fuel is gasified, the carburetter in which the blue water gas is mixed with oil vapours, the superheater for fixing the oil vapours, and in many cases a waste heat boiler. The plant is usually designed to operate on the backrun process by means of which better control over temperature conditions in the various vessels can be maintained efficiently and maximum advantage taken of the available heat in the blow gases, thereby economising in fuel consumption. The operation follows a carefully



View of operating platform, showing automatic hydraulic operator and instrument panel.

prepared cycle, two, three or more minutes in length and usually made up of five phases; blow; blow purge; initial uprun; backrun; final uprun.



Top portion of superheater at operating platform level

Belgian Lead and Copper

Difficulties in Refining Industry

DIFFICULT conditions in the Belgian non-ferrous metals refining industry were outlined in the annual report of the Societe Generale Metallurgique de Hoboken, presented at the recent annual meeting. While activities of the electrolytic refinery and chemical plants at Oolen have steadily improved during the year, and are now practically normal, the Hoboken and Reppel plants have been operated at only a fraction of their capacity. It had been impossible to obtain sufficient quantities of lead ore and cupriferous materials to secure economic operation of the Hoboken plant, and it was only within the last few weeks that the first quantities of cassiterite and unrefined gold to be delivered since the war arrived from the Congo.

Supplies of crude copper for the Oolen plant from the Union Miniere du Haut-Katanga and, to a less extent, from other sources, has permitted practically normal operation of the electrolytic refinery, while the Union Miniere has also provided cobalt ores sufficient to utilise nearly half the capacity of the plant. The Reppel plant, manufacturing arsenical salts from by-products of the Hoboken and Oolen plants, has been seriously affected by lack of raw materials.

The raw material position is improving and will, it is hoped, continue to improve as shipments from the Union Miniere increase and contacts with other producers in the Belgian Congo and elsewhere are resumed. Owing partly to the fact that plants were working below capacity, and partly to heavy increase in labour and material costs, the year closed with a slight loss of 107,250 francs, and no dividend could be distributed. All war damage had, however, been written off

SAFETY FIRST

Amenity as a Feature of Chemical Plant—V

by JOHN CREEVEY

ACCORDING to my dictionary, amenity is a matter of things being pleasant; of the situation in which one lives or works having features which make it pleasant for living or working. Recalling conditions observed when visiting numerous chemical and allied works, it is a little difficult to point to any particular amenity which demanded improvement, because conditions change so much from works to works, yet very high on the list comes the avoidance or actual removal of impurities which pass into the air as a result of the intensive working of plant. An inadequately-ventilated atmosphere is bad enough of itself for working in, but when dusts, fumes, and vapours are also present it becomes far more unpleasant. The resulting falling-off in efficiency of the individual workers has never been properly measured, yet such figures would certainly be enlightening.

As regards the dispersion of contaminating material into the outside atmosphere of the works, it should be understood that the actual design and installation of any exhaust system is a matter for the practical engineer. All that may be done here is to offer advice on how best to attack the problem.

Solid and liquid particles will disperse by the kinetic energy of their own motion if they are large enough and are thrown off with sufficient velocity. If such particles are truly microscopic in size, their dispersion relies mainly upon the movement of the air in which they are suspended. For vapours and gases, on the other hand, the linear velocity making for diffusion does not usually exceed one foot per minute, and is therefore unimportant as a dispersing force. Accordingly, as they are lighter or heavier than air, they rise or fall in the air relative to the position of their source, but unless the difference in density is considerable, the rate at which they escape is not high; in consequence, the nuisance they cause may quickly increase in intensity or at least persist for a considerable time.

Dangers from Vapours

Vapours which are particularly heavy constitute a very grave menace, because they are likely to collect in pockets of high concentration wherever conditions are favourable. The chief safeguard against this is the avoidance of air stagnation by good methods of ventilation. If the vapours or gases are of approximately the same density as the air into which they escape, they are dispersed to a relatively high degree by the mere movement of the air.

In all exhausting systems for reducing the nuisance and attendant hazards of impurities in the air, the object of the exhaust hood is to collect the contaminated air rather than to remove the contamination from the air. The hood, in turn, allows the contaminated air to be conveyed through ducts to a convenient point of dispersion in the outer atmosphere, where its ill-effects are no longer suffered, or where it may be treated (if necessary) to render it harmless. But equally important, apart from the hood, its size and precise situation, is the control of air motion. In the first place it is necessary to eliminate all possible air currents which are otherwise unessential to the maintenance of adequate ventilation; secondly, it is necessary to reduce the velocity of air currents immediately adjacent to hazardous processes, or at least in the vicinity of a point where dusts or particles of liquid, or vapours or gases, escape into the air. Insofar as air currents cannot be eliminated, or have their velocity appreciably reduced, they must be put under control and made to flow into the exhaust hood.

Movement of Air

A study of the sources of air movement in the vicinity of industrial processes will reveal the complicated nature of the problems which are likely to arise. In some cases the movement of the air is fundamental to the machine or the process, as where there is fan-action from a rotating wheel, or where screens are in vibration, or there is mere escape of air as containers are filled by liquid. In other cases the air may derive its initial movement from forces incidental to the operation of a particular machine; for example, there may be badly placed exhaust ports, undue vibration of machinery, etc. A third source of air movement comes from the drag of air by large particles which are dynamically projected, as where a stream of sparks is thrown tangentially from a grinding wheel and the resulting air current in the same direction disperses the dust from the wheel. Fourthly, there are sources which may be considered truly external to the machinery or process, as where convection currents arise, or open conveyors are in operation, or perhaps uncontrolled draught from without.

Better conditions as regards air movement in the immediate vicinity of a point where impurities enter the air are easy to effect if the conditions are carefully studied. A slight alteration may be needed in the operation of the process; the removal of external sources of air motion may be indicated, or the shielding of hazardous processes from such air currents, as where improvement is effected by enclosing nearby moving belts, or enclosing "open" conveyors and elevators. It is also possible to prevent the machinery (likewise the process) from creating undesirable movement of air, by enclosing certain parts and shielding others. The fan-action of a grinding wheel can be adapted for the collection of its own dust; a vent may be provided for the safe escape of air from mixers, storage bins, and containers as they are filled with either powdered material or some volatile liquid.

Vibration

The movement of air due to unnecessary vibration of machinery can be avoided by providing proper foundations, and otherwise giving attention to machine design; here, incidentally, another amenity arises in the elimination of noise, which can be irritating to the worker, but sometimes equally rhythmic. The problem of completely eliminating air movement, however, is a difficult matter, although conditions rarely necessitate such a course; it is the improvement of conditions which should be the main aim, in order that the subsequent collection and removal of the contaminated air may be done most effectively before the impurities thrown into the air are able to become more of a menace.

Hoods for the collection of contaminated air have to be correctly designed for the place in which they are used, and for other conditions. The air velocity towards the hood has to be high enough to counter any outward velocity of contaminated air, and that demands the least possible total rate of air-flow. Actual measurements may have to be made, the desirable rate of airflow being determined experimentally by varying conditions until quantitative tests show them to be at the optimum for satisfaction.

Apart from exhaust pipes or ducts to convey the contaminated air to a safe point of dispersion, it may also be necessary to install air-cleaning plant. This is dictated by the need to prevent the creation of a nuisance or a hazard in the immediate vicinity of the outlet from the exhaust system; the need to prevent the re-contamination of plant air from outside; and perhaps to allow the recirculation of air discharged from the exhaust system. The concentration of the contaminating material in the discharged air coming from the exhaust system must never be high enough to create a hazard, and strict control by periodical testing has to be practised for that purpose. Where dust is present it must be collected by use of cyclone extractors, unless the amount present be negligible; dangerous vapours must be destroyed by scrubbing the discharged air, or by burning it. The disposal of collected dusts, etc., must be done without exposing the workmen to any incidental hazard. At times the dust may be exceptionally dangerous to handle in the absence of proper precautions being taken.

The disposal of contaminated air is most simply carried out by passing it through a high chimney. Here dilution with clean air, and ultimate dispersal by favourable wind currents, certainly allow concentration to be reduced to a safe level, yet so much as regards the efficiency of this means of disposal depends upon local conditions from day to day. Even in a fully isolated situation there may be eddies in the air which result in a return of the contaminated air to ground level; the eddies, with their resultant downdraught, are more likely to occur in a built-up factory area, and the nuisance may have serious repercussions when contamination from one works falls upon another works adjoining. In any case, even when the exhausted air is discharged through a tall chimney, it is still necessary to remove all solid particles which are large enough to settle out by aid of settling chambers, cyclones, and other means of inertial separation.

Fine Dust Danger

One point still needs emphasis. By means of primary dust separators it may be fairly simple to remove large particles of dust carried in the exhaust air, yet such means of separation may fail to remove minute particles which may constitute a serious health hazard in favourable situations. From the works amenity viewpoint it is therefore desirable to do all that is possible to prevent the production of dust in any operation which is necessary for the continuance of a chemical process; likewise, to prevent the escape of dangerous vapours and gases into the works atmosphere. In this connection much can be achieved by giving careful attention to the selection of machinery and plant accessories, as also by the adoption of a rigid plant maintenance programme. Good maintenance of plant parts does a great deal to attain pleasant conditions for plant personnel.

A Russo-Danish trade agreement provides for the export, by the U.S.S.R., of 100,000 tons potassium fertiliser, 3000 tons pig-iron, 2000 tons gypsum, 100 tons antimony and 10 tons of silver. The export of oil derivatives and of metals is also envisaged.

Carbon Black Suspensions

Thixotropic Properties

AT a meeting of the London Section of the Oil and Colour Chemists' Association, held at 26 Portland Place, London, on December 4, Dr. J. E. Arnold read a paper entitled "Some Rheological Properties of Carbon Black Suspensions." Mr. R. J. Ledwith, chairman of the section, presided.

Dr. Arnold devoted the main part of his lecture to an account of some unpublished work, carried out in 1939, on the thixotropic properties of suspensions of carbon black in non-polar paraffin, containing very small additions of a third component. He said it is unfortunate that rheologists have not yet evolved a generally accepted formal definition of the term "thixotropy." In the industries with which the association was concerned, it had been his experience that technical staffs had, for the most part, extremely vague and comfortably accommodating ideas as to what constitutes thixotropic behaviour. He added that of those classes of fluids which do not obey the ordinary Newtonian laws of flow, those which possess rigidity (i.e., a yield value) when at rest, and show an isothermal, reversible decrease in viscosity with increase in rate of shear would, for the purpose of this lecture, be regarded as thixotropic, although he was aware there were other ideas on the subject.

Effect of Third Component

Having dealt briefly with the technique and apparatus, and given some of the results obtained with the simple two-component system, carbon black/non-polar paraffin, Dr. Arnold dealt in more detail with the behaviour observed when a third component was added to the system. He said that the use of such compounds as oleic, linoleic, and benzoic acids, and of blown oils and stand oils to reduce the thixotropic tendencies of paints and printing inks was well known, and there were many references to such behaviour in the literature. It was frequently assumed that such added substances assisted the wetting of the dispersed pigment by the medium and that the greater the extent of such wetting the less the degree of thixotropy. Such an assumption, however, appeared to ignore the fact that the literature also described a number of instances where the reverse effect was observed, using the same or similar added substances.

He then discussed the effect of the third component on "residual viscosity" and the "coefficient of thixotropy," and described a series of tests.

The effect of concentration of the third component was also discussed, the general types of behaviour to be expected having been ascertained, and the results were shown in a series of curves.

Discussing the results of the tests, Dr. Arnold said that much confusion still seemed to persist in the technical literature as to the meaning of the terms "wetting" and "dispersion." His views coincided with those expressed by Dr. Bowles in a paper before the Association in January 1938. By "dispersion" was signified the mechanical process by which large aggregates of pigment particles were broken up and distributed more or less evenly throughout the medium. A dispersing agent could only be a piece of machinery. "Wetting," on the other hand, was understood to involve the adsorption of molecules of the medium on the surface of the suspended particles. Good "wetting" was thus effected when strong adsorption occurred, and vice versa.

Thixotropy and Welting

No one would deny that carbon black was poorly wetted by liquid paraffin, or that oleic acid, for example, was a good wetting agent for many pigment/vehicle dispersions. Yet in the work he had described, there were three sets of circumstances in which the coefficient of thixotropy was respectively increased, unchanged and decreased by the addition of a good wetting agent. If, therefore, it was to be stated that thixotropy implied poor wetting and vice versa, it must be assumed that in those cases where the residual viscosity was either unaffected or increased by the addition of oleic or palmitic acid, these substances were not acting as wetting agents; in other words, they only did so when the residual viscosity was lowered. Alternatively, it must be deduced that thixotropy was not necessarily bound up with the wetting at all.

Experiments

In the course of the discussion, Dr. R. F. Bowles said that wetting was not simple and in nearly all cases—and particularly with carbon black—they were displacing something from the carbon. Experiments carried out in the laboratories with which he was associated indicated quite clearly that with carbon black, this displacement, which was thought to be water, went on even in a well dispersive medium such as stand oil, and his experiments had shown that after four minutes this gradual displacement went on and the dispersions were becoming more and more fluid and were breaking down the structure. The American workers had pointed out that very small traces of water could induce thixotropy.

Chemical Aspects of Silage-Making

Address in Dublin by Professor A. I. Virtanen

ADDRESSING the Royal Dublin Society on December 10, on "The Ensiling of Green Fodder," Professor A. I. Virtanen, Director of the Biochemical Institute, Helsinki, and 1945 Nobel Prizeman in chemistry, dealt with the chemical aspects of silage making.

He said that there were three ways by which decomposition of nutrients was caused during conservation of fresh fodder: (1) Respiration of plant cells, whereby carbohydrates were lost; this occurred only at the start of conservation; (2) detrimental fermentation, whereby carbohydrates were decomposed by micro-organisms and organic substances lost by cleavage of carbon dioxide; (3) protein breakdown caused by micro-organisms, which partly led to cleavage of ammonia from amino acids.

The problem was to prevent these processes and yet not make the fodder nutritionally deficient. Of the two means of achieving this, one was by inhibition of the processes by bactericidal substances, and the other, by the adjustment of the hydrogen ion concentration, popularly called the acidifying of the fodder mass to a definite value.

Importance of Acidity

Laboratory experiments had shown that the acidity of the fodder remained constant for an unlimited time if the acidity of the fodder mass was raised at the time of ensiling by an addition of sufficient acid to a *p*H value between three and four, and the effluent was allowed to drain off. If the addition of acid was insufficient and the *p*H of the fodder mass remained over four, the detrimental processes were no longer arrested. Formation of ammonia, and lactic acid fermentation to butyric acid then started, raising the *p*H of the silage and giving further opportunities for decomposition. It appeared that *p*H4 was the lowest acidity at which fodder could be conserved with certainty. Drainage of the effluent from the silo was vitally important since the *p*H of the fodder lying in solution rose and decomposition set in.

Quantitative tests of the acid required for adjustment of the proper *p*H of the fodder showed that fewer strong acids were needed than weak ones and that acid requirements varied for different forage plants. The higher the protein content of the plants, the greater their requisite amount of acids. The acid and lime content of the soil also effected the acid requirements.

As material losses in silage could occur only through effluent or by evolution of gases, an apparatus for the collection of gases and effluent was devised. The only gas found, at any rate in silage below *p*H4, was carbon dioxide, which was first formed partly through respiration and partly through fermentation. The amount of carbon dioxide formed indicated, not only the loss of organic substances, but also the extent of detrimental fermentations.

Amino acids constitute the physiologically important compounds of protein. If the decomposition did not pass the amino acid stage, the value of the protein did not change, if the present scientific conception was right. A clear idea of the decomposition of proteins was obtained by determining how much ammonia was formed from the total nitrogen during the conservation.

The wholesomeness of the acidified silage was tested in various ways. The results of the analyses from different parts of bones, teeth and tissues did not show anything exceptional. The calcium, phosphates and chlorine content of the blood were normal. The only change was in urine, the reaction of which changed from alkaline to acid. The combined carbon dioxide was simultaneously decreased and the ammonia content increased. But this was corrected by the use of soda and limestone mixture in feeding.

A New U.S. Insecticide

Rival to DDT

A NEW insecticide toxicant, Toxaphene, has been announced by the Hercules Powder Company, of Wilmington, Delaware. Preliminary tests indicate that Toxaphene is fully as effective as DDT against some insects and more effective against others. Toxaphene is a chlorinated camphene. For the past 18 months it has been undergoing tests in more than 75 different places throughout the United States under the name of Hercules Synthetic 3956.

These extensive tests indicate that it can be used effectively in agricultural, household, and industrial insecticides. It is reported to be effective against such insect pests as cotton insects, tobacco horn worm, Mexican bean bettle, flies, clothes moths, and roaches.

Toxaphene can also be combined with Thanite, a toxicant possessing "knockdown" properties, for use where both quick knockdown and residual properties are desired. Toxaphene is, at present, available only to qualified testing agencies for experimental use.

SOUTH AFRICAN CHEMICAL NOTES

(From our Cape Town Correspondent)

MANUFACTURERS of heavy and other industrial chemicals in the United States and Canada have been showing increasing interest in the South African market and recently several new agents were appointed in Johannesburg and Cape Town, among other centres, to push the sale of such products in the Union.

This has not meant any slackening off in the demand for similar chemicals from Britain, for the state of the South African market at present is such that it can absorb most of the various types of chemicals that Britain can export to it, despite increasing competition in certain directions from local manufacturers.

With a few exceptions, however, South African chemical manufacturing is more of a mixing industry than a manufacturing industry, for it is still necessary for many of the so-called local chemical industries to import large quantities of processed or semi-processed chemicals.

Aerial Spraying of DDT

Dr. R. du Toit, ex-president of the South African Biological Society, in an address to the Pretoria branch, said that two weeks after the last of a series of three DDT sprayings of the Mkusi area of Zululand, carried out by aircraft at the end of last year, the number of tsetse flies caught in traps in that area had dropped to only 7 per cent of the pre-spraying total. From about the end of March of this year, however, a gradual increase in the number of flies had occurred. The figures had not reached the pre-spraying numbers by the time this year's operations were started. In these operations, using a new method, daily catches of flies dropped from between 150 and 200, before the first spraying early in August, to 10-15 after it.

Hydrolysed Protein

A plant for the production of hydrolysed protein by a process devised by Col. H. Watkins-Pitchford, C.M.G., has been established on the premises of the Premier Whaling Company, Durban, by the Natal branch of the South African Red Cross, and is now in operation. The flesh of both whales and oxen could be used with equally good results. Beef that is normally unfit for human consumption is entirely satisfactory for the raw material of the process, and it is hoped that the use of such beef will create a new market for uneconomic "scrub" cattle.

The whale meat, under the existing conditions of food shortage throughout the world, would be a valuable source of nutriment not now being fully utilised; it is practically indistiguishable from that produced from beef. Protein would be incorporated in various forms of foodstuffs and there is a likelihood that this would result in the establishment of new industries in the Union for the production of invalid food, biscuits, toffee, nutrified wine and stout. Hydrolysed protein has had a marked success in the treatment of tuberculosis, malnutrition, and other allied diseases.

Campaign Against Metal Rust

The South African Railways and Harbours Administration will soon save thousands of pounds annually, as a result of a carefully conducted campaign against rust. The campaign is taking the form of the comprehensive testing of hundreds of different paints at various centres in South Africa. When the tests are completed, the railway authorities expect that the "terrific expenditure" on paints and labour to maintain structural steel works such as bridges will be cut to a minimum. Only proved paints will be used, and the ravages of rust will be stayed for years.

An official at railway headquarters in Johannesburg said that railway chemists were taking no chances in their fight against rust. "More than 1000 panels of mild steel are being used in exposure tests to determine the reactions of various paints to atmospheric conditions in Johannesburg, De Aar, Port Elizabeth, Durban, and Umkomass," he said. "These widespread tests will enable the authorities to choose the best rust-resisting paints. In some instances in the past the paints used involved the Government in great expense, because they provided protection against rust for only about three or four months. This unnecessary expense will be avoided in the future. The scheme was instituted in 1939, when three chemists were specially employed by the railways. Their work was interrupted by the war, but now they travel four times a year to the different towns where the tests are being made. Detailed charts of the results are kept, and by the end of this year definite data will have been obtained."

New Coal-Tar Plant

A modern plant for producing tar from coal, which is now being assembled at the Johannesburg municipal gas works, Cottesloe, will increase the municipal revenue derived from the gas works from £20,000 to

£30,000 a year—besides enabling local industries to manufacture perfumes, flavourings, and even substitutes for sugar. The present output of the gas works plant is about 80,000 gallons of crude tar a month. The new plant, which will be ready early next year, will be capable of producing more closely defined "fractions" than the present obsolete stills. It will also enable distillates to be made to meet purchasers' specifications, although the municipality will concentrate on a limited number of products.

The increase in output of coal tar will have a big bearing on local industry because of its many uses. Mr. J. G. Curnow, municipal gas engineer and manager, said that, as an example, nearly every flower perfume and many artificial perfumes could be made from a tar base. This also applied to a number of flavourings, such as vanilla, thyme, violet, almond and cinnamon. In addition, substitutes for sugar, such as saccharine, were derived from tar, as well as dyes and many kinds of explosives. He said that for every ton of coal used in making gas, 12-14 gal. of tar were recovered. Several hundred substances had been identified in coal tar by chemists, he said, and in the primary distillation the oil recovered was usually separated into five categories well known to chemists.

Glass and Enamel

A new £1,000,000 Johannesburg company plans to link with its glass department an enamelling works where castings, particularly baths, basins, sinks and cisterns, will be finished. The purpose of housing the enamelling works adjacent to the glass department is to make use of waste heat from the glass-melting furnace to pre-heat the castings prior to their entering the electrically heated enamelling stoves. This will effect very marked economy in the working of the latter, and will greatly improve the temperature control in the first electrical stove when the ground coat is applied. A high-class enamel has been developed and thoroughly tested, and will be produced from local materials. It is claimed that the cost of this enamel will be but a fraction of that of the imported article, and this, together with the heat economy, will place the company in a strong position to meet competition from imports.

Merchandise Marks

Sections 8 and 9 of the Merchandise Marks Act, which was due to come into force on September 1, have been suspended indefinitely. These sections relate to the compulsory marking of goods not made in South Africa. The two sections were suspended following representations from commercial organisations on the practical difficulties involved in complying with their requirements, and the possible effect on the Union's supply position should compliance be insisted upon at present.

Austrian Plastics

Allied Commission Aids Recovery

A SURVEY of the plastic industry in Austria in 1938 gives an account of more than 100 plastic firms, with about 2500 workers and a raw material value of 25,000,000 marks. The largest works produced a product similar to Bakelite, which was used for various purposes and covered almost the whole home demand.

The picture changed considerably after the annexation of Austria by Germany. The I.G. Farben concern gradually eliminated Austria's production as a result of the stopping of casein imports from Finland and America, and the impossibility of obtaining other raw materials. Only a small production was maintained for war purposes, as long as stocks were at hand, but after the end of the war materials were obtainable from Czechoslovakia and Switzerland.

Extensive research is now being undertaken with a view to the production of new plastics. In the meantime, the gap is being bridged by the Allied Commission placing at the disposal of the plastic industry substantial quantities of nitrocellulose from surplus Army stores. There are many favourable factors to facilitate a recovery of the plastic industry in Austria. Most of the necessary raw materials exist in the country, particularly wood-flour and lignite. Phenol and formaldehyde are lacking at present, but no insurmountable difficulties exist for a home production of formaldehyde, while phenol can be obtained at gasworks. For the present, however, these raw materials will have to be imported: phenol from the coke industries of Czechoslovakia and Poland, and formaldehyde from Czechoslovakia, Jugoslavia, Roumania, and Hungary.

The existing plastic plants, although partly destroyed by bombing, might soon be repaired and set to work with a capacity to supply not only the home market, but also to provide exports. New plants are intended for the production of compression-moulding plastics.

In China a programme has been worked out to provide considerable assistance to growers of tung trees. Production of tung oil is estimated to reach this year only 60,000 tons. or about one-half of the pre-war output.

Potash from the Dead Sea

Palestine Company's Progress

STARTED in 1930, the work of the Palestine Potash Company was greatly widened during the war years, and not only has a great area in the south been added to the larger basin areas north of the Dead Sea, which are connected by a fleet of small vessels, but operating methods have been improved and output greatly increased.

The salts which characterise the Dead Sea are those of potassium and bromine. The Sea is the only lake still "at work," accumulating year after year considerable quantities of these and other salts. The reason for this phenomenon is the fact that the Jordan and its tributaries flow over potassium-containing layers, mainly marls which form the layers on the upper parts of their beds. As for the bromine, there is evidence that the Jordan derives its bromine salts exclusively from the hot springs of the Sea of Galilee which contain bromine, and supply water to the lake.

The Palestine Potash Company was granted a 75 years' concession as from January, 1930, and undertook to produce 1000 tons of potassium chloride in the third year, 1500 tons in the fourth year, and 10,000 tons in the eighth, nine and tenth years respectively. After that the company was scheduled to produce 50,000 tons annually. The company further undertook to employ a certain percentage of labour from Transjordan, to which a part of the Dead Sea is considered to belong. All the conditions of the concession have been fulfilled, and in the eighth year of its existence the company manufactured, instead of 10,000 tons, a total of 63,000 tons of potassium chloride. During the war Palestine was the most important supplier for the Allies and, to meet war needs, production was vastly increased.

Bromine and Bromine Salts

A special branch of the production is devoted to the manufacture of bromine and bromine salts. The Dead Sea is the main source of bromine in the world. Recently the company, with the help of the Hebrew University, developed a new and modern method of extracting the bromine, and especially pure bromine salts. The production of the latter has now become an important part of the company's activities. The fertilising industry takes the lion's share of the potash salts, but the disposal of all the bromine that could be manufactured by the company is still a problem and is the subject of research and investigation.

A first-class staff of chemists working in the well-equipped laboratory in Jerusalem, as well as on the spot at the Dead Sea, are striving to develop additional products connected with potassium and bromine, as well as with magnesium, the importance of which has increased, particularly in the last decade.

There are enormous stocks of magnesium salts in the Dead Sea in a highly concentrated solution, but a magnesium undertaking must be based on the availability of cheap fuel, which in turn depends on the price policy of the oil companies in Palestine. If the price of oil fuel could be kept down to a reasonable level, there is every possibility that the Palestine Potash Company would be able to develop a magnesium metal-producing industry. The company lately announced its intention of participating in the development of the industrial production of other fertilisers, mainly superphosphates, and they propose with other interested parties to erect a factory for the production of sulphuric acid. With the aid of sulphuric acid, potassium sulphate, which is still in demand by many agriculturists, could be manufactured.

U.S.A. PLANT EXPANSION

At their Deer Park plant in Houston, Texas, the Shell Chemical Corporation proposes spending $2,500,000 on the expansion of facilities for producing methyl ethyl ketone and secondary butyl alcohol, output of which is expected to be increased by 150 per cent. The alcohol is used in lacquers and in the manufacture of compounds for use in ore flotation. Methyl ethyl ketone has many uses in lacquers, lacquer thinners, moulded plastics, artificial leather, aircraft dopes, de-waxing of lubricating oils, and in printing and lithography. Also included in the production expansion plans is a chemical designated "D-D" (not to be confused with DDT) which is a soil fumigant, toxic to soil-borne pests attacking plants, and which is claimed to have resulted in crop increases of from 100 to 300 per cent.

Ground prosphate production in France amounted to 20,000 tons in October, a notable increase over the monthly average of 12,500 tons in 1938. Output of carbonate of soda was 10,500 tons above the pre-war average, while oxygen output increased from 1,850,000 to 3,000,000 cubic metres. Output of ammonia declined to 15,900 tons, against a pre-war monthly average of 18,500 tons; sulphuric acid production was 75,000 tons against the pre-war figure of 106,000 tons, while chloric acid was 2750 tons below the 1938 average.

PARLIAMENTARY TOPICS

Export of Steel Sheets.—In the House of Commons last week Air Commodore Harvey asked the President of the Board of Trade what quantity of steel sheets under 3 mm. in thickness had been exported in each of the last three months to the U.S.S.R., Germany and France, and how many tons of similar steel sheets were in stock awaiting shipment to these countries.

The Parliamentary Secretary informed him that during August to October the only exports to these countries of steel sheets of thickness under ⅛ in., which was just over 3 mm., were six tons to France in August and four tons in September. No information was available of stocks awaiting shipment.

Pre-war Use of Linseed Oil. — The President of the Board of Trade was asked by Mr. Hubbard which industries received an allocation of linseed oil; what tonnage each received; and how this compared with their pre-war usage.

Regarding the first two parts of the question, Sir Stafford Cripps referred him to an answer by the Ministry of Food on November 27 (*see* THE CHEMICAL AGE, December 12, 1946, p. 708). As regards the last part, Sir Stafford said the Census of Production Reports for 1935 showed that the paint, varnish and white lead group of industries used in that year 47,900 tons of linseed oil and the linoleum and leather-cloth industries 33,900 tons. The printing ink industry used 3055 tons of vegetable oils of all kinds.

Increased Price of Linseed Oil.—Explaining why the controlled price of linseed oil in Britain had been raised from £65 to £135 per ton, in answer to Sir Waldron Smithers, the Minister of Food said it was to cover the increased cost of this commodity in the present conditions of extreme shortage.

Glue and Gelatine Exports.—Mr. Erroll asked the President of the Board of Trade the separate quantities of domestically produced glue and gelatine exported monthly since the re-imposition of the Control of Glue (No. 3) Order.

Such figures. however, were not available, according to Mr. Marquand. Exports of animal and fish technical gelatine and glue and size were 95 tons in August, 152 tons in September, and 92 tons in October, he added.

Reduced Lead Stocks.—Every effort was being made to import as much lead as possible, but in present conditions of world shortage he saw no prospect of building up stocks, said Mr. Leonard, replying to Mr. Marples, who asked the Minister of Supply if he were aware that stocks of refined lead had fallen from 121,900 tons at July, 1945, to 19,800 tons at September, 1946.

Shortage of Geologists. — Asked by Mr. Rankin if he were prepared to appoint a commission to undertake a geological survey of Tanganyika, Uganda and Kenya, the Secretary of State for the Colonies declared that he was alive to the need for a much increased effort in the sphere of geological survey in the Colonies generally, including the East African territories. His recently appointed geological adviser was bringing all these questions into immediate review and would advise him on the best means of obtaining speedy results.

"The chief limiting factor," added Mr. Creech Jones, "is the shortage of trained geologists; and I should like to take this opportunity of reiterating my earlier appeal to young men entering upon higher studies to consider the attractions of this important profession in the Colonies."

Requisitioned Industrial Premises. — Of 40,900,000 sq. ft. of industrial floor space still under requisition by Government departments, 28,900,000 would be derequisitioned by the end of the year, the Parliamentary Secretary, Board of Trade, stated in reply to a question from Mr. S. Shephard.

PURIFICATION OF NEW SYNTHETIC ELEMENTS

Speaking before the Rochester (New York) section of the American Chemical Society, in the second annual Harrison Howe lecture, Dr. Glenn T. Seaborg, University of California nuclear chemist, reported that Americium, the synthetic element 95, has been isolated in a pure compound in a large enough quantity to study it on the ultramicrochemical scale. Dr. Seaborg said that details of the chemical properties of the synthetic element have been learned by Dr. B. B. Cunningham, assistant professor of chemistry.

"This work of Cunningham's is a remarkable achievement in that the amounts availabe here were even smaller than those in the case of neptunium and plutonium," Dr. Seaborg said, and added that "this is the third synthetic element which has been isolated in pure form."

A CHEMIST'S BOOKSHELF

Organic Reactions. Vol. III. Edited by Roger Adams, p. 460. Chapman and Hall, London. $5.

Organic chemists again have cause to be thankful that Roger Adams and his collaborators have produced a third volume of *Organic Reactions*. The contents of this volume deals with nine important synthetic reactions which are: the Friedel-Crafts method for alkylating aromatic compounds, the Willgerodt reaction, preparation of ketenes and ketene dimers, sulphonation of aromatic hydrocarbons, and their halogen derivatives, azlactones, substitution and addition reactions of thiocyanogen, and a chapter each on the Hofmann, Schmidt, and Curtius reactions.

The first chapter on the Friedel-Crafts reaction deals only with the methods by which aromatic hydrocarbons, some phenols and phenol ethers can be alkylated. It does not deal with the production of ketones by using acid chlorides or anhydrides. The greater part of the chapter is occupied by numerous tables which list the various types of substance alkylated and gives such details as the nature of the alkylating agent, the catalyst, and the quantities used together with the solvent, time and temperature of the reaction, names and yields of the products, and a reference to the original papers. Before these tables there are a few general remarks on the reaction in general, such points as the best catalysts for various types of reaction being mentioned, together with the possibility of re-arrangement of the alkyl groups and other limitations. In this chapter, as in all other cases, a selection of experimental directions is given although it would have been an advantage to give another example of the alkylation of a phenol apart from using liquid hydrogen fluoride as a catalyst.

The second chapter is devoted to a series of closely related reactions which are concerned with the conversion of a carbonyl compound into an amide with the same number of carbon atoms. The original method used by Willgerodt has subsequently been modified by Kindler and others, and these modifications are described and in the experimental directions are found examples of both types.

In view of the wide uses of ketenes and the large amount of work published on these compounds recently it is most welcome to find this chapter where directions are given for the preparation of these compounds in the laboratory and where the numerous patents on the subject are listed and reviewed.

The next chapter, that on sulphonation, will have a wide appeal owing to the very general use of this type of reaction. The nature of various sulphonating agents are at first considered together, with a few words on the formation of sulphones as the most common by-products. Then follows a brief description of the results obtained on sulphonating various hydrocarbons from benzene to poly-nuclear compounds such as naphthalene, anthracene, and phenanthrene, and including halogenated benzenes. Incorporated in the selection of experimental procedures are listed various methods for the isolation and identification of sulphonic acids. The tables which follow are divided, as in the first chapter, according to the nature of the compound undergoing sulphonation.

In the chapter on azlactones various methods for their preparation are given together with a discussion of their properties and the reaction which they undergo. Particular attention is paid to the various types of compounds which can be prepared from azlactones.

Chapter 6, on the reactions of thiocyanogen, follows much the same layout as that on sulphonation in that the types of compounds which may be thiocyanated are discussed and the various methods for generating thiocyanogen given. No less than eight examples are given in the section on experimental procedures which is followed by a list of compounds which may be substituted in this manner.

The last three chapters follow the same pattern in that the mechanism of the reactions is discussed together with the scope and limitations involved. There then follows a selection of experimental conditions and procedures together with tabulated lists of the compounds which have been prepared or subjected to the Hofmann, Schmidt or Curtius reactions.

As will be readily appreciated from the outline above there is much in this new volume which will be of the greatest use to all organic chemists particularly those engaged on research who normally have to spend so much time in searching the literature. G.S.D.

Personal Notes

Mr. R. Park Guild has been appointed deputy managing director of Salts (Saltaire), Ltd.

Mr. R. E. Williams, a member of the staff of Monsanto Chemicals, Ltd., at Ruabon, has now received from the King the George Medal he won while serving with the R.A.F.

Dr. C. F. Bareford, M.Sc., Ph.D., who was formerly with the B.T.H. Company and later went to the Admiralty, has been appointed manager and head of the new electronics research laboratory of Mullard Wireless Service Co., Ltd.

Dr. B. S. Gidvani, who, until recently, was director of the London Shellac Research Bureau, has returned from an extensive tour of India and Europe. As from January 1 he will be available at 25 Cheyne Place. London, S.W.3, for consultations on the uses of shellac, etc.

Dr. Kathleen Lonsdale has been appointed Reader in Crystallography in the Department of Chemistry of University College, London. Her appointment marks the first important step in the creation of a new university centre for the training of crystallographers and crystallographic research workers.

Mr. T. T. Walton, joint managing director of Smith & Walton, Ltd., Haltwhistle, and Mr. J. Clarkson, director of the Strathclyde Paint Co., Ltd., Glasgow, have been elected president and vice-president respectively, of the National Federation of Associated Paint, Colour and Varnish Manufacturers of the United Kingdom for the year 1946-47.

"THE BULLETIN"

In the form of a brightly-edited, informative and entertaining bi-monthly, *The Bulletin* of Johnson, Matthey & Co., Ltd., Hatton Garden, London, E.C.1, provides the necessary link between the 3000 persons connected with this and associated companies. Numbers 1 and 2 have just reached us and, enlarged in size and expanded in contents, show a commendable advance on the modest stencilled sheets with which the idea was started eight years ago and which carried on despite wartime difficulties. If the standard of material presented in these first two numbers is maintained, it should prove of value as well as interest to all concerned—perhaps even to outsiders.

Research on Cast Iron

An Important Discovery

A PROCESS that will involve a new approach to the design of iron castings and influence every branch of the industry was referred to by Dr. Harold Hartley, president of the British Cast Iron Research Association, when speaking at the silver jubilee luncheon of the association in London on December 11.

Dr. Hartley said research on the process was started at the association's research station at Bordesley Hall, Alvechurch, Birmingham, in 1936, after the association had made public a method showing how fine graphite structures could be produced from a titaniferous iron. To-day, in the laboratory, 20-30 ton tensile cast irons can be produced by casting an ordinary hematite pig iron suitably treated.

How scientists have succeeded in casting iron into the mould with a graphite structure of nodular or spherical form was described by Dr. Hartley, who said he regarded as most significant the fact that the new process is applicable to irons most easily castable and least subject to shrinkage in casting. The virtually new material possesses the properties of the present high-duty cast irons and yet remains readily castable and machinable. It will not supplant high-duty irons, but rather will be used as a base for producing high-duty cast irons, the properties of which will no longer be determined by the flake graphite structure

Another feature of the new material, described by Dr. Hartley, is its uniformity in properties from piece to piece. No bar tested showed any flaw. Strength, deflection and shock resistance are doubled or even trebled.

Latest types in their range of mechanical water meters of the rotary semi-positive type for domestic and industrial supplies are described by George Kent, Ltd., Luton and London, in a new publication, No. 906/1946. The various types are fully detailed, with ample illustrations, methods of operation being explained, followed by installation and maintenance notes, data chart and selection guide. An interesting feature of the booklet is a brief survey of the development of the firm's water meters from 1883, in which year the manufacture of water meters was inaugurated, the first stage being an agency for the Meinecke Inferential Meter. A picture of this early model is given, along with pictures of the three succeeding models, including the up-to-date "M" type, which is now extensively used by water authorities and industrial undertakings all over the world, as shown by photographs in the booklet.

Home News Items

The Library of the Chemical Society will be closed from Tuesday, December 24, until Saturday, December 28, inclusive.

Numerical and classified lists of D.T.D. Specifications, with a list of relevant B.S. Specifications cancelled since April, 1930, are now obtainable from H.M. Stationery Office (6d.).

Visits to Germany by British business men desirous of renewing old contacts and exploring possibilities for trade when Germany is allowed to trade again may soon be permitted under a plan reported to be under discussion in Berlin between British Administration officials in conjunction with commercial experts.

A plea for continued co-operation between science and industry was made by Dr. D. T. A. Townend, formerly Livesey Professor of Coal, Gas and Fuel Industries at Leeds University, when he gave the second Brotherton Memorial Lecture to the Society of Chemical Industry in Leeds on December 12. Industry, he said, was competing strongly for our most able scientists and, though great strides had been made through the Department of Scientific and Industrial Research and through some of the universities, there was still a long way to go.

Wholesale prices, as measured by the Board of Trade index number, rose by a further 0.8 per cent in November. This was the largest rise since July, when seasonal changes in price affected the index to a considerable extent. The rise last month was essentially confined to non-ferrous metals and textiles. The increase of 4.5 per cent in the non-ferrous metals group was due to advances in copper and zinc prices, the full effect of which, however, will not be shown in the index till December. Since this time last year, the group as a whole has risen by 37½ per cent.

The prices of refined glycerine will be advanced on January 1, 1947, by £37 10s. per ton, making the new basis prices for B.P. quality £120, and for industrial pale straw £115 per ton, compared with to-day's prices of £82 10s. and £77 10s. The usual additions to these prices for smaller quantities and packages will be continued and the other terms of sale are unchanged. In making this announcement, the United Kingdom Glycerine Producers' Association adds that the new prices are an attempt to approximate to a reasonable level of post-war value for glycerine in relation to the higher values of other commodities.

The number of employees at the new Dunlop factory at Speke, Liverpool, has passed the 5000 mark.

Seeking a bigger allocation of linseed oil, representatives of employers and employees in the Kirkcaldy linoleum industry attended a conference in London this week with the President of the Board of Trade.

Since our report last week of Britain's purchase from the Argentine of 200,000 tons of vegetable oils, including 100,000 tons of linseed oil, it has been suggested that the International Emergency Food Council may allocate to this country the entire consignment of seed oil and cattle cake.

Business communications with Germany, "of a limited character," are now permitted under the terms of a general licence issued by the Board of Trade by arrangement with the Postmaster-General. Arrangements have also been made for the transmission of powers of attorney to the British zone of Germany and the British sector of Berlin through official channels.

To promote, protect and further the status and interests of instrument technology, including design, application, use and maintenance of instruments used for scientific and industrial measurements, the Society of Instrument Technology, Ltd. (425,588) has been registered as a company limited by guarantee without share capital. Management is vested in an executive council, including Mr. D. A. Oliver, Director of Research, B.S.A. group; Mr. W. J. Clark, instrument research manager of I.C.I., Billingham Division; and Mr. R. E. W. Iggledene, works manager, British Rototherm Co., Ltd. The registered office is 80. Bishopsgate, London, E.C.2.

The metals and chemicals sections absorbed nearly 50 per cent of the 93,000 increase during October in the labour force employed in manufacture for the home market, as revealed in employment figures for the month issued by the Ministry of Labour and National Service. The present total working population is shown to be 606,000 more than in mid-1939, this being accounted for by there being 700,000 more women at work, the number having remained stationary in October at 5,806,000, whereas the number of men at work dropped by a further 46,000 to 14,550,000 and is now 106,000 below the 1939 figure. Unemployment between October 14 and November 11 again showed little change.

Overseas News Items

The export price for U.S. copper, f.a.s. New York, has been advanced one cent to 19.50 cents per pound.

Farmers in the United States bought fertilisers worth 440,000,000 dollars during 1945, compared with 400,000,000 dollars in 1944 and 215,000,000 dollars in 1939.

The B. F. Goodrich Chemical Co., of Cleveland, Ohio, has entered the biochemical field and will soon be producing a wider range of agricultural, textile, pharmaceutical, and household chemicals.

The French Ministry of National Economy has lifted the price control on gum arabic, insoluble gums, copal, benzoin and other gums.

Holland produces at present about 300 to 325 metric tons of crude oil monthly, derived from twelve producing wells in Drente Province, located chiefly round the village of Schoonebeek. Current output covers 8 per cent of the country's total requirements.

Linseed exports from Uruguay are likely to be controlled. A Bill recently submitted to the Senate proposes an export duty of 10 per cent on the difference between the current quotation and the three-yearly average price for the years 1937-39 inclusive.

The Shell Chemical Corporation intends to manufacture synthetic glycerine on a commercial scale at its Houston, Texas, plant, early in 1948. Production in the new plant, the erection of which costs about 7,000,000 dollars, will be based on propylene chlorine and caustic soda.

The Peruvian Minister of Public Health has issued a Supreme Resolution which lays it down that national laboratories engaged in the manufacture of insecticides and parasiticides are to be under the control of qualified chemists holding a diploma of a Peruvian university.

Algeria has a small chemical and fertiliser industry. The largest firm, the Sapce (Société Algérienne de Produits Chimiques et d'Engrais) has three plants, producing mainly sulphuric acid, superphosphates, copper and iron sulphates, carbon disulphide and oxygen, as well as various secondary types of fertilisers. Capacity for the production of sulphuric acid is about 100,000 tons per annum, but far less has been produced. This information is included in a review of economic conditions in Algeria published by the Canadian *Commercial Intelligence Journal*.

Penicillin is to be manufactured by a company recently established at Joettingen in the British zone of Germany.

For combating a locust plague, the Greek Ministry of Agriculture is seeking to purchase from the United States 100 tons of Gammexane.

Spain and Norway are to export 115,000 tons and 30,000 tons of pyrites to the British occupation zone of Germany. These shipments should make it possible to maintain production of sulphuric acid in that area.

Rich deposits of uranium in China are now controlled by Russia, according to unconfirmed reports. The deposits, it is claimed, were originally discovered by the Japanese about 140 miles from Port Arthur, which is open to Russian vessels.

Important deposits of bentonite on the east coast of New Zealand are being investigated by the New Zealand Geological Survey Department and hundreds of tons of the mineral have already been recovered, according to reports from Wellington.

Canada's imports of chemicals and allied products in the eight months' period of January to August, 1946, increased 18 per cent in value over those in the same period of 1945. The imports amounted to \$61,548,000 for the 1946 period, and \$52,042,000 for 1945.

The Japanese Ministry of Welfare, in cooperation with the Ministry of Education, is to supervise research, production and distribution of penicillin, the large-scale production of which is actively planned in the country. A U.S. expert has arrived to teach the Japanese mass-production methods.

Czechoslovakia is now tackling the task of implementing the Two-Year Plan which became law in October. Under this, hard coal production is to be increased in 1948 by 17 per cent over present figures; brown coal production is to be increased by 21 per cent; and pig-iron by 36 per cent.

German and Austrian scientists have saved the United States more than 750,000,000 dollars in basic research on rockets alone and advanced American research in several fields from two to ten years, according to a War Department estimate. Foreign technicians working in the States already number 270 and it is hoped to increase the total to 1000. Their work covers, among other fields, electronics, supersonics, synthetics, and phases of applied physics and chemistry.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

AFFINED BASIC CHEMICALS, LTD., London, W. (M., 21/12/46.) November 20, charge, to Westminster Bank, Ltd., securing all moneys due or to become due to the Bank; charged on Empire Works, Newland Meadows, High Wycombe, including fixtures. *Nil. October 16, 1945.

Satisfactions

BRITISH BENZOL & COAL DISTILLATION, LTD., Bedwas. (M.S., 21/12/46.) Satisfaction November 27 of Trust Deed registered September 21, 1937.

Company News

For the year ending May 15 next, the **Distillers Co., Ltd.,** is paying an interim ordinary dividend of 1s. 6d. per £1 of stock (equal to 7½ per cent actual).

With net profit totalling £13,251, as compared with £13,059 for the previous year, **Crystalate Ltd.** is again paying an ordinary dividend of 6 per cent for the year ended September 30.

Dividend of 8 per cent on the larger capital for the year ended June 30 is being paid by **Midland Tar Distillers, Ltd.,** who paid 7 per cent the previous year. Net profit of £49,599 compares with £39,381.

Genatosan, Ltd., reports net profit of £55,242 for the year ended June 30, as against £45,516 for the previous year. The interim ordinary dividend of 10 per cent and final of 40 per cent compare with a total of 30 per cent for the previous year.

An ordinary dividend of 5 per cent, as against 3½ per cent for the previous year, is being paid by **English Clays Lovering Pochin & Co., Ltd.,** for the year ended September 30. Net profit of £227,875, compared with £134,379.

As from January 1, all Dunlop goods sold in Scotland, except clothing and Semtex, will be handled by a separate Scottish company, the **Dunlop Rubber Co., (Scotland) Ltd.** Its capital is £50,000 in £1 shares and the directors are Mr. G. E. Beharrell, Dunlop managing director, who will be chairman; Mr. H. L. Kenward, Dunlop director of distribution; Mr. J. H. Lord, Dunlop financial comptroller; and Mr. William Sinclair, Dunlop regional manager for Scotland.

New Companies Registered

W. M. Gardner & Co., Ltd. (425,115).—Private company. Capital £1000 in 1000 shares of £1 each. Research and analytical chemists, etc. Subscribers: L. Stiles; F. Barnsdale. Registered office: 68, Kilburn Park Road, London, N.W.6.

Nuodex International (U.K.) Ltd. (425,518).—Private company. Capital £1000 in £1 shares. Industrial chemists, etc. Directors: E. Bader; A. Cooper; E. Fairhead. Registered office: 66, Victoria Street, London, S.W.1.

N. Redmond & Co., Ltd. (424,749).—Private company. Capital £100 in 100 shares of £1 each. Consulting, chemical and industrial engineers, etc. Directors: N. Redmond, Mrs. K. Redmond. Registered office: 41, Store Street, Manchester, 1.

Nelson MacNeill & Co., Ltd. (424,660).—Private company. Capital £1000 in 950 6 per cent non-cumulative participating preference shares of £1 and 1000 1s. ordinary shares. Analytical and consulting chemists, etc. Subscribers: G. Hughes; A. James. Registered office: 71, Moorgate, London, E.C.2.

Chemical and Allied Stocks and Shares

STOCK markets are closing the year on a firm note, apart from British Funds, which moved fractionally lower following moderate selling. Home rails showed firmness earlier in the week on hopes that the Transport Bill debate might induce the Government to amend the "compensation" terms. There was good demand for industrial shares, partly on benefits that should be derived by a large number of companies from the abolition of E.P.T.

Chemicals and textiles were prominent among securities favoured on export trade news, buyers appearing to give main attention to shares of companies in industries outside the threat of nationalisation. Iron and steels have been favoured on E.P.T. considerations, as have shares of paint manufacturers, although the latter also remained under the influence of the Lewis Berger dividend increase and the British purchase of linseed oil from the Argentine.

Imperial Chemical rose to 45s. 3d., B. Laporte to 103s., Burt Boulton showed firmness at 27s. on the higher profits disclosed by the full results, while Fisons were

dealt in up to 62s. 6d., and Greeff-Chemicals Holdings 5s. ordinary were 13s. 6d. British Drug Houses at 61s. 3d. were again bought as the company should be a substantial beneficiary from the abolition of E.P.T. Borax Consolidated deferred displayed firmness at 48s. 3d., and British Aluminium strengthened to 46s. British Match have been firm at 54s., and Lever & Unilever were 52s. 6d. Imperial Smelting further improved to 22s. and, following the meeting, Tube Investments were higher at £6 13/16, while at £10¾ International Combustion again reflected higher dividend hopes and share "splitting" talk.

Textiles were helped by benefits likely to be derived from the higher dollar value of exports. Coates were prominent with an advance to 70s., English Sewing Cotton were 37s. 6d., Bradford Dyers 26s. 6d., Bleachers 14s. 7½d., and Courtaulds 54s. 3d. In the paint section, Lewis Berger moved to the new high level of £8, International Paint rose to £7 1/16, and Indestructible Paint to £6. Pinchin Johnson were 51s. 9d., and Goodlass Wall 32s. 10½d. In other directions, Wall Paper Manufacturers rose to 49s. before easing to 47s. 6d.

The units of the Distillers Co. eased to 139s. 6d. on the unchanged interim dividend, while United Molasses at 55s. 3d. failed to hold best levels; but elsewhere, British Plaster Board further strenghened to 34s. 3d., and British Oxygen have been firm at 101s. 10½d. Birmid Industries were 99s. 4½d. on the full results and forthcoming capital increase. Firmness was maintained in British Glues 4s. ordinary at 17s. 3d. with the participating preference 48s. 6d. In other directions, Blythe Colour 4s. shares showed dealings up to the higher level of 50s., while there was activity up to 57s. 4½d. in Morgan Crucible "A" ordinary. A weak feature was provided by a sharp decline of up to seven points in German Potash Bonds, which were sold on doubts whether they will receive priority in reparations payments.

Among iron and steels, Guest Keen firmed up to 46s. 6d., Dorman Long were 28s. with the preferred ordinary good at 50s. Stewarts & Lloyds were 55s., Whitehead Iron 99s. 6d., while elsewhere, Barrow Hæmatite showed a fresh rise to 41s. 6d. South Durham Steel moved up to 27s. 3d., and Ruston & Hornsby to 66s. Babcock & Wilcox were good at 70s. 6d.

Boots Drug strengthened to 64s., Griffiths Hughes rose to 63s. 3d., Sangers were 34s., and Timothy Whites 49s. 6d. Oil shares have been uncertain. Anglo-Iranian rallied to £5 following the latest news from Persia, but were later 99s. 4½d. Apex (Trinidad) and Anglo-Ecuadorian Oilfields at 39s. and 38s. 6d. respectively showed firmness on the higher distributions, although prices eased subsequently, Shell and Burmah Oil also losing a little ground.

British Chemical Prices

Market Reports

A STEADY movement of supplies in the London general chemicals market has been reported during the past week, with new business increasing in volume where the supply positions permit. Actual price changes have been few, but the undertone is strong throughout and higher quotations in the New Year would not be unexpected. As reported last week the controlled prices for acetic acid and acetone are likely to be revised in the near future, and an advance in the price of refined glycerine as from January 1 has already been notified. An increase in the permitted price of sulphuric acid of strengths of 155° Tw. and below has been authorised by the Board of Trade and came into force on December 9, 1946. The demand for export is fully maintained and inquiries cover a wide range of industrial chemicals and pharmaceutical products. In the coal-tar products market chief attention is being given to contract replacement. Little change is expected in quoted rates and no immediate improvement in the supply position is looked for.

MANCHESTER.—In spite of the approach of year-end influences, including stocktaking, there has been little sign as yet of any easing of activity on the Manchester market for light and heavy chemicals. Inquiry during the past week for the general run of alkali products, as well as other leading heavies, has been on steady lines from a wide range of using industries, and new business is being placed freely. Buying interest on export account has also been prominent. Actual price changes have been few apart from those announced for refined glycerine and certain strengths of sulphuric acid, but the undertone generally is undoubtedly very firm. Activity in most sections of the tar products market so far as the movement into consumption is concerned has continued in evidence.

GLASGOW.—An exceptionally busy week has been experienced in the Scottish heavy chemical market owing to an unprecedented demand for chemical raw materials of all kinds, presumably before price changes take effect in 1947. The heavy demand is also reflected in contracts which are up for renewal, and all indications are that 1947 will be at least equally busy. The export market showed little change, and considerable business was secured, including such chemicals as magnesium, sulphate, zinc chloride; ground limestone, salt, saltpetre, sulphur, nitric acid, caustic soda, soda crystals, and dyestuffs. A number of products showed marked increases in price, and generally markets remained very firm.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification

Applications for Patents

Recovery of alloying elements.—C. Stokes, and D. Wright. 33524.

Non-detonating compositions.—J. Taylor, A. C. Hutchison, and I.C.I., Ltd. 33234.

Gaseous discharge tubes.—Telefonaktiebolaget L. M. Ericsson. 33513.

Anthridine compounds.—Wellcome Foundation, Ltd., F. C. Copp, and L. P. Walls. 33072.

Vaporisation of crude oil, etc.—H. Wright. 33101.

Thermal power plants.—A.G. für Technische Studien. 34258.

Treating wool scour water.—P. S. Allam. (Fields Point Manufacturing Corporation.) 34596.

Heat treatment of magnesium base alloys. —Aluminum Co. of America. 34676.

Biguanides.—American Cyanamid Co. 34392.

Aromatic amines.—J. C. Arnold. (Standard Oil Development Co.) 34317.

Chemical reaction process.—J. C. Arnold (Standard Oil Development Co.) 34318.

Alumina hydeosols.—J. C. Arnold. (Standard Oil Development Co.) 34963.

Treatment of hydrocarbon.—D. Balachowsky. 34369.

Ethylene derivatives.—British Schering Research Laboratories, Ltd., J. S. H. Davies, and W. Tebuch. 34463.

Polysiloxane resins.—British Thomson-Houston Co., Ltd. 34540-34541.

Binding agents.—Ciba, Ltd. 34249-50.

Hydrophenthrene derivatives.—Ciba, Ltd. 34887-90.

Dyestuffs.—S. Coffey, D. A. W. Fairweather, D. E. Hathway, and I.C.I., Ltd. 34643, 34886.

Dyestuffs.—S. Coffey, D. A. W. Fairweather, F. H. Slinger, and I.C.I., Ltd. 34644, 34885.

Dyestuffs.—S. Coffey, D. A. W. Fairweather, D. E. Hathway, F. H. Slinger, and I.C.I., Ltd 34642.

Refining acetone.—Commercial Solvents (Great Britain), Ltd., T. Benfield, and H Holdsworth 34272.

Recovery of acetone.—Commercial Solvents (Great Britain), Ltd., H. N. Darlington, and H. Holdsworth. 34874.

Surface coating.—Continental Can Co. Inc. 34275.

Purification of acetic anhydride.—Courtaulds, Ltd., and J. G. Spencer. 34260.

Phenolic resins.—Dunlop Rubber Co., Ltd., and M. Goldstaub. 34192.

Rubber derivatives.—Dunlop Rubber Co., Ltd., F. A. Jones, and G. A. Truesdale. 34597.

Metal heating furnaces.—E. S. Elliott, and H. H. Brookes. 34207.

Fuel burners.—L. S. E. Ellis. (Robertshaw Thermostat Co.) 34268.

Aroxy silanes.—H. G. Emblem, E. O. Powell, C. Shaw, and W. E. Smith. 34305.

Dispersion of rubber latex.—Firestone Tyre & Rubber Co. 34231.

Extracting oils from solids.—J. Fretwell, and M. J. Wildgoose. 34706.

Complete Specifications Open to Public Inspection

Chemical process.—Merck & Co., Inc. May 16, 1945. 13242-3/46.

Paint compositions.—Metals Disintegrating Co., Inc. May 19, 1945. 8760/46.

Method of and apparatus for effecting circulation of a liquid for heating or other purposes.—H. G. Montgomery. May 17, 1945. 14852/46.

Manufacturing mouldings of synthetic resin material suitable for high-tension insulation. N.V. Philips Gloeilampenfabrieken. Jan. 22, 1943. 30967/46.

Manufacturing mouldings from a phenol-formaldehyde artificial resin moulding material capable of being hardened and containing wood-flour as a filling material. —N.V. Philips Gloeilampenfabrieken. Jan. 23, 1943. 30969/46.

Manufacture of stable cysteine preparatons.—Roche Products, Ltd. May 17, 1945. 28751/46.

Synthetic gem composition.—D. Rosenthal. May 19, 1945. 6770/46.

Process for the separation of isomeric substituted quinoline carboxylic acids and esters thereof.—Soc. des Usines Chimiques Rhône-Poulenc. May 17, 1945. 11194/46.

Production of dinitroethyleneurea.—Stein, Hall & Co., Inc. Feb. 25, 1944. 499/45.

Method of bleaching alginic acid.—E. Sundve. April 19. 1945. 32096/46.

Producing a thermoplastic transfer sheet and transfer coating therewith.—Sylvania Industrial Corporation. May 18. 1945. 11766/46.

Process of coating, article for use therein, and the products produced thereby.—Sylvania Industrial Corporation. May 18, 1945. 13616/46.

Process of coating and article for use therein.—Sylvania Industrial Corporation. May 18, 1945. 14934/46.

Cellulose ethers and process for producing the same.—Sylvania Industrial Corporation. May 19, 1945. 14935/46.

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Production of relatively volatile metals by reduction of their ores in an electric furnace.—Union Miniere de Haut Katanga. May 17, 1945. 16494/46.

Adhesive compositions.—United States Rubber Co. Aug. 12, 1943. 14245/44.

Manufacturing aqueous solutions of alkyloxy or alkenyloxy-2 nitro-5 anilines.—A. P. Weber. May 15, 1945. 2413/46.

Metal alloys.—Westinghouse Electric International Co. May 16, 1945. 14037/46.

Complete Specifications Accepted

Process for the production of polymers.—P. Davies, D. K. Peacock, J. E. Fearey, and I.C.I., Ltd. July 28, 1944. 582,266.

Ceramic abrasive or refractory material. —E.I. Du Pont de Nemours & Co. March 21, 1942. 582,091.

Laminated glass sheets.—E.I. Du Pont de Nemours & Co. Aug. 13, 1941. 582,087.

Manufacture and use of insecticidal compositions.—Geigy Colour Co., Ltd., and I. E. Balaban. Dec. 18, 1943. 582,205.

Process for the manufacture of α.γ-dyhydroxy-β-β-dimethyl-butyric-acid-(3[1]-hydroxypropyl)amides.—F. Hoffman-La Roche & Co., A.G. June 14, 1944. 582,156.

Interpolymers of ethylene and organic vinyl esters.—I.C.I., Ltd. June 6, 1942. 582,093.

Process for the polymerisation of esters of acrylic acid and derivatives thereof.—I.C.I., Ltd. Aug. 26, 1943. 582,167.

Production of chlorinated paraxylene derivatives.—I.C.I., Ltd. June 18, 1943. 582,258.

Manufacture of moulding powders and moulded articles therefrom.—Leicester, Lovell & Co., Ltd., and H. A. Collinson. Feb. 1, 1944. 582,247.

Cracking hydrocarbon oils.—Lummus Co. Dec. 10, 1941. 582,175.

Product and process for manufacturing rubber.—Permanente Metals Corporation. March 20, 1944. 582,268.

Vapour phase isomerisation of hydrocarbons.—Shell Development Co. June 6, 1942. 582,138.

Detection and quantitative determination of carbon monoxide in air or other gases at such temperatures as occur in the atmosphere and reagents therefor.—J. D. Main-Smith, and G. A. Earwicker. July 12, 1943. 582,184.

Manufacture of derivatives of sulphonated amines.—Soc. of Chemical Industry in Basle. Dec. 24, 1941. 582,092.

Process for improving the properties of textiles dyed with vat dyestuffs.—Soc. of Chemical Industry in Basle. Jan. 6, 1943. 582,143.

Manufacture of 6-(para-aminobenzenesulphonamido)-2 : 4 - dimethylpyrimidine.—Soc. of Chemical Industry in Basle. Nov. 4, 1943. 582,149.

Process and apparatus for the polymerisation of olefinic materials.—Standard Oil Development Co. May 27, 1942. 582,137.

Water dispersible casein urea formaldehyde composition and its preparation.—W. Teape & Co. (1919), Ltd., H. F. Rance, and G. F. Glover. Aug. 10, 1944. 582,235.

Water dispersible urea-formaldehyde composition and its preparation.—W. Teape & Co. (1919), Ltd., H. F. Rance, G. F. Glover, and E. J. Pritchard. Jan. 5, 1945. 582,157.

Process for carrying out condensation reactions of substances containing reactive methylene or methine groups.—C. Weizmann. March 2, 1944. 582,191.

Quinoline substituted dihydropyridines. —Wellcome Foundation, Ltd. May 15, 1941. 582,254.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

BOUVERIE HOUSE, 154 FLEET STREET, LONDON, E.C.4

Telegrams ALLANGAS FLEET LONDON — Telephone: CENTRAL 3212 (12 lines)

GLASGOW: 116 Hope Street (Central 3970) — BIRMINGHAM: Daimler House, Paradise Street (Midland 0784-5)

THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LV No. 1435. — December 28, 1946 — Annual Subscription 21s. Overseas 26s.

Coal Hydrogenation

THAT the possibilities of economic production of oil for the internal combustion engine by the Fischer-Tropsch process are remote was indicated in these columns a few weeks ago as the result of a paper by Dr. C. C. Hall to the Institute of Fuel. Another nail was well and truly hammered into the synthetic oil coffin as the result of a paper by Mr. Kenneth Gordon on December 9 to the same body (*see* THE CHEMICAL AGE, Dec. 21, pp. 761-770, and pp. 795-804 of this issue). Mr. Gordon, having been largely responsible for the working of the hydrogenation plant at Billingham, speaks with authority. To be sure, his paper contains no direct appraisement of the economics of the process. It might even appear from the account of the brilliant work done at Billingham that the process is still very much alive. But the paper left in the minds of many the feeling that the days of coal hydrogenation are numbered—at least for many years to come—and this feeling was expressed in the debate by many of those who took part.

The achievements of those who designed, operated and directed the process of coal hydrogenation in this country during the war were striking. The process was not only operated to capacity in spite of adverse conditions, but extended to include products not thought of as commercial possibilities when the hydrogenation process was first devised by Bergius. The rising price of coal has compelled the operators to use oil as the raw material. That change was dictated for economic reasons, but also arose because of the time taken to close down a coal-hydrogenation unit when an air-raid was in progress. The overall thermal efficiency of the oil-hydrogenation process is much greater than that of the coal-hydrogenation process.

One of the earliest improvements made during the war was the use of the methane-steam process for the manufacture of hydrogen. Considerable quantities of methane are produced during hydrogenation and some 17 per cent by weight of total hydrocarbon gases are given by the author as derived from the processing of a ton of creosote oil. Methane treated with steam in the presence of a nickel catalyst gives almost complete conversion to hydrogen and carbon monoxide. Passage over a second catalyst, consisting of iron-chromium, enables the CO in this gas to be used for the production of further supplies of hydrogen. This method is of great interest to the oil industry and was also incorporated in a second hydrogenation plant that was erected at Heysham.

On Other Pages

The Heysham plant incorporated many improvements that had been discovered as the result of the work at Billingham.

There has been a progressive increase in the volatility of the oils produced both at Billingham and at Heysham as compared with the earlier Billingham practice. The oils were sold through the normal petrol distribution channels and thus from the beginning had to be in line with the specifications of the petroleum companies. Before the war petrol was made of commercial grade, No. 1 premium, both straight and leaded, and also 87 octane number aviation fuel. During the war at both plants, the manufacture of 87 octane number aviation spirit was continued, but in addition there were produced pool petrol and base spirit for the manufacture of 100 octane petrol. A goodly portion of the more volatile hydrocarbons produced consisted of butane. This was dehydrogenated to butenes, followed by polymerisation and hydrogenation to iso-octane.

It had been decided early in 1939 to install plant for the production of 10,000 tons a year of iso-octane and this plant went into operation in October, 1940. From May, 1942, the manufacture of 87 octane number petrol was discontinued and the sole output of the Billingham plant was 100 octane aviation components. From 1943 the Billingham plant was run in conjunction with the Heysham plant, which worked on gas oil, not on creosote, and with the Shell Company's iso-octane plant at Stanlow, the object being to produce the maximum quantity of aviation spirit. A further change was made in 1944 when one of the Billingham hydrogenation units was converted to the manufacture of butyl benzene, also used as an aviation spirit component. This was made by alkylation of benzene with the butylenes obtained from the iso-octane units, so that its manufacture was alternate to that of iso-octane. Butane, of course, can be sold as bottled gas and large quantities were sold for this purpose. A propane recovery plant was also added, the propane being used as a substitute for acetylene for metal cutting. Finally, it may be noted that the hydrogenation product contains considerable quantities of phenols and as long ago as 1937 a plant was installed for the production of phenol and cresols; if means could be devised for greatly increasing the yield of these compounds, a step of considerable importance would be taken towards rendering the hydrogenation process economic.

This is a brief resume of some of the more important steps that have been taken. The process has been improved by the discovery of new catalysts and this account would be incomplete if some mention were not made of the very valuable work done in this connection. Thus for vapour-phase hydrogenation, the preferred catalyst up to 1935 appeared to be a mixture containing zinc oxide, magnesium oxide and molybdenum oxide. A big step forward was the discovery by the I.G. of tungsten sulphide and this is still used for some purposes. A further step forward was made in 1935 when the value was discovered of a mixed catalyst composed of 10 per cent tungsten sulphide supported on alkaline earth. Finally, the most important discovery appears to have been that of new catalysts for the second stage of the two-stage vapour-phase method in which the tungsten was replaced by iron. A very ingenious method was worked out for controllng the temperature of the vapour-phase method—a most necessary condition of successful operation—in which the convertor was divided into numerous sections and between each two sections the vapours could be mixed with cold gas and re-distributed over the next batch of catalysts.

This discursive and incomplete recital of some of the more important developments has been given with a purpose. That purpose is to indicate the immense amount of hard research, chemical engineering skill, and expenditure of human effort and material resources that have been put into the hydrogenaton process. Whether the process is continued or not—and we feel it highly probable that the hydrogenation of creosote and of gas oil will continue—that skill and effort has not been wasted. It has given to this country the "know-how" which no amount of theoretical study could possibly have done. Mr. Gordon confirmed this view, and said that much of the technique used in this group of processes had been of inestimable value in other I.C.I. processes. There is a sense in which fundamental work in chemical engineering can be just as valuable and just as necessary as fundamental work in science. This is an outstanding example of the truth of that principle. It would be a bad day for the country if such fundamental work were discontinued; but there appears to be only the one company that can hope to do such work on a sufficiently comprehensive scale.

The hydrogenation work was engendered by war; its need may have passed with the conclusion of the second German war; we hope it has, but an immense amount of good must remain.

It is a curious fact that any process that is devised for the chemical utilisation of coal or coal products appears to be applicable immediately and mainly to the petroleum industry. The pipe still for oil distillation was devised originally for coal tar, but was applied primarily to the oil industry until in the past 10 or 15 years it has been again used largely for the distillation of coal tar. Diesel introduced his engine with the intention of using it for coal dust, but found its application lay in the utilisation of heavier petroleum oils. The Fischer-Tropsch process has been developed for use with reaction gas mixtures made from coal, coke or coal gas, but these sources of synthesis have now proved too costly, and the cheapest synthesis gas is provided by the methane derived from natural gas through the steam-methane reaction. Now also, hydrogenation, originally designed to deal with coal, seems likely to be used primarily in the oil industry as a means of dealing with heavy oils. Will fuel oil in future be hydrogenated, so that no fuel oil will be available for burning purposes? It is greatly to be hoped that means will be found to enable the various processes devised as a result of the work of the past 20 years to be continued with creosote oil as their raw material. The proper use of creosote oil is surely not to burn it as such, but to convert it into a series of high-value products, aviation spirit, iso-octane, butyl benzene and so forth. We trust that this great work will not be found to have ended in the "glorious failure" predicted by so many of those who took part in the debate at the meeting of the Institute of Fuel. Whatever may be the ultimate outcome, something of very great value has resulted from what has here been done.

NOTES AND COMMENTS

B.A.C. STATEMENT OF POLICY

THE statement of policy issued by Mr. Norman Sheldon on his election as president of the British Association of Chemists, will, we think, be welcomed by most members of the association. This forthright announcement of the association's aims and policy, and the rigid refusal to be associated with any political party, will clear the air and perhaps induce chemists to take a greater interest in their organisation. The B.A.C., Mr. Sheldon pointed out, is registered as a trade union so that its functions may be performed more efficiently, but that it does not mean political affiliation with any party. Although political association of the B.A.C. as a whole is eschewed, individual political liberty is encouraged in fact, members of the association may receive financial backing it they feel called upon to play their part in the field of public affairs, no matter to what party they chose to belong. In addition to this the news that the association is exploring the possibility of starting up a superannuation scheme which will be transferable from one firm to another, is a further welcome indication of enlightened progress.

FENCING DANGEROUS MACHINERY

THE very wide extent of the duty to fence dangerous machinery was illustrated by the successful claim of a workman in the High Court. He was injured in rather unusual circumstances. A piece of a neighbouring machine broke away, flew out of its holder and struck and injured him. The man who was operating the machine was uninjured. The machine which broke had the usual type of guard, but it was proved that it would have been possible to provide a better guard which would probably have prevented the injury. The workman's claim succeeded on the ground that the employers had been guilty of a breach of the statutory duty which they owed under the Factories Acts—"every dangerous part of any machinery shall be securely fenced" and under special regulations affecting this particular machine "the cutter of every vertical spindle moulding machine shall when practicable be provided with the most efficient guard having regard to the nature of the work to be performed." The employers set up the argument that the special regulations were intended for the protection of the worker at the machine only.

Mr. Justice Hilbery rejected this argument, while admitting that the primary purpose of the regulations was the protection of the operator. He held that on the facts the most efficient guard had not been fitted and that the injured worker was therefore entitled to damages.

LOST PRODUCTIVITY

A REPORT from the U.S. Bureau of Labour Statistics gives figures which show that over a long period worker productivity in the U.S. has doubled every twenty years. Even in the years 1939 to 1945 worker productivity in 32 industries rose 6.6 per cent. It is expected that when the major industries, such as the motor-car industry, are fully re-converted, output figures will continue to show a rapid rise in the years to come. Worker productivity, however, the report says, is not measured solely on the energy or efficiency of the worker. The skill of the management, the efficiency of the tools provided for the workers, and the over-all rate of production at which the industry is performing are equally important factors. It adds that productivity can be measured in advance by the amount of money spent by industry in providing new and better machinery. The U.S. Government apparently believes that labour productivity is due to rise unusually rapidly in the future as more and more industries are re-opening and getting into full production. This picture from the U.S. is in striking contrast with the sombre colours of the British scene. Many prominent people in this country, including Cabinet Ministers, have repeatedly called attention to the decreased productivity over here. The latest warning comes from Sir Claude D. Gibb, president of the North-Eastern Section of the Institute of Production Engineers. At Newcastle on December 12 he said that output per man hour to-day was lower than it was before 1939 and much lower than during the war. The reasons given, said Sir Claude, varied according to one's political, economical or medical outlook. Although much was said of the lost incentive of the workers, no mention was made of the lost incentive in management, of the manager suffering from malnutrition, or being "fed up" with high taxation. Nothing, he said, would be more dangerous than management fatigue. Although management fatigue does not figure in the American report, nor ways of dealing with it, we can visualise some easy cures for this complaint. Coincident with management fatigue is machine fatigue, the only remedy for which is the provision of more and better machinery to give greater productivity. Sir Claude Gibb claimed that horsepower must be made the servant of each producer by building more machines, tools and mechanisms which would produce more articles per hour per man employed than hitherto. With this view we are in accord. If our productive power is declining we must make and use tools which will take over and thus save valuable manpower.

ALICE'S LOOKING GLASS

A TRANSPARENT mirror, many of which are now being manufactured in the U.S., is an apparent contradiction in terms. But this mirror simultaneously acts as a reflecting surface when viewed on one side and as a window from the other. This peculiar performance is due to a thin film of chromium alloy, four ten-millionths of an inch thick, with which the glass is mirrored, so that while acting as an effective reflector it also permits passage of light. This is a wartime discovery now being put to a peacetime use. Cinema fans will remember this type of mirror was used in a spy film, "The House on 92nd Street," where G-men were able to take photographs of the spy headquarters through a bath room cabinet fitted with such a transparent mirror. There are many uses to which this mirror can be put, *e.g.*, in doors or windows of houses so as to permit of the occupants examining any caller without revealing their own presence. Among other applications are observation windows in clinics and in television production and advertising displays.

Fire Protection

The under-lying principles of fire protection in buildings are reviewed in a report just published, "Post-War Building Studies No. 20—Fire Grading of Buildings" (H.M. Stationery Office, Kingsway, London, W.C.2, 1s. 6d.). The report is the work of a joint committee of the Building Research Board, the Department of Scientific and Industrial Research and the Fire Offices' Committee, and is published for the Ministry of Works.

PROGRESS IN HYDROGENATION OF COAL AND TAR*

by KENNETH GORDON, C.B.E., M.C.

In vapour-phase hydrogenation the vaporised oil mixed with hydrogen is passed over a solid catalyst. The boiling range of the oil that can be treated is determined by the ratio of gas to oil, and in practice we find that an end point of 330° C. is the upper limit. Good fractionation with sharp cutting is necessary. Oils from petroleum, oils made by the hydrogenation of coal or tar, and oils obtained by distillation from both high-temperature and low-temperature tar are equally suitable for the process. The greater the amount of hydrogen to be added, the greater is the heat evolved and the greater the amount of attention that has to be paid to the arrangements for controlling temperatures.

TABLE VIII.

OPERATING CONDITIONS AND YIELDS FOR LIQUID-PHASE HYDROGENATION OF CREOSOTE HEAVY OIL.

Operating conditions

(These relate to a 2-converter stall of 18.8 m^3 reaction volume).

Catalysts	CC1[4]	0.01 to 0.04 per cent. on cold feed.
	Iodine	0.02 per cent. on cold feed.
	Tin oxalate	0.01 per cent. on cold feed.
Creosote HO consumption rate		5.3 tons/hour; 0.28 tons/m^3 reaction volume/hour.
Total cold feed rate		11 to 14 tons/hour.
Hot recycle heavy oil		10 tons/hour.
Inlet gas		13,500 m^3/hour.
Cooling gas		6,500 to 11,000 m^3 hour.
Preheater exit temperature		420 to 480° C.
Temperature in first converter		445 to 475° C.
Temperature in second converter		460 to 475° C.
Inlet pressure		246 atmospheres.
Inlet hydrogen partial pressure		200 atmospheres.

Overall yields (weight per cent. of creosote heavy oil treated):

	Per cent.
Refined petrol, 170° C. F.B.P.	11.2
Middle oil, 170° C. to 320° C.	70.7
Liquor	2.0
Hydrocarbon gas	17.0
Loss	3.8
Hydrogen used	4.7

In the information published up to 1935, the preferred catalyst appeared to be a mixture containing activated molybdenum oxide, a typical analysis being:

Zinc oxide	31 per cent
Magnesium oxide	15 per cent
Molybdenum oxide	54 per cent

Such catalysts work at relatively high temperatures, and give relatively low yields with high gas formation. A big step forward was made in 1930, when the IG discovered the suitability of pure tungsten sulphide, WS_2 (5058) as a hydrogenation catalyst. This catalyst is extremely active both from the point of view of hydrogenation and for splitting. It is equally suitable for any type of feed stock. It is necessary to ensure a minimum concentration of sulphur, either in the oil or in the hydrogen, in order to maintain continuous catalyst activity, and this concentration depends on the composition of the oil. The natural sulphur content of oils is generally enough except in cases where the feedstock is abnormally low in that element, as is generally the case if the oil is itself a hydrogenation product. The sulphur can either be added as elemental sulphur or as H_2S. The latter is preferred, and the H_2S can be recovered from the gases leaving the plant and recycled.

Important Advances

The tungsten sulphide catalyst was a big step forward from the point of view of yield, and it needed a lower temperature for operation. The product had a better boiling range than that from the earlier catalysts, which were apt to give material deficient in light boiling compounds, because of the very largely aromatic nature of the product. On the other hand, the low aromatic content of 5058 petrol was responsible for it having a comparatively low knock rating (68 to 70), and it tended in the mid-1930's to become inadequate for market requirements.

A timely further step forward was made in 1935 by the discovery of a mixed catalyst, composed of 10 per cent tungsten sulphide supported on activated earth (6434). This catalyst gave very similar results, so far as yields were concerned, as the pure tungsten sulphide, but the product had a greatly improved knock rating. This new catalyst could be used directly for some petroleum oils, but lost its activity quickly if coal or tar oils were used without pretreatment. Such materials need a preliminary hydrogenation before they can pass to the new catalyst. Catalyst 5058 is very suitable for this first stage.

A decisive, although probably not the only, factor is the nitrogen content of the oil, and it is found in practice that the nitrogen content must be maintained below 5 parts per million for the catalyst activity in the second stage to remain at a high figure. Circulating hydrogen must also be

* Continued from *The Chemical Age*, December 21, 1946 (*see* pp. 761-70).

freed from ammonia by water washing. Under these two-stage conditions, the temperature required for satisfactory splitting hydrogenation over 6434 is lower than is necessary in the single-stage 5058 process.

The preliminary nitrogen removal over 5058 catalyst inevitably results in the production of a certain amount of petrol, for example, by conversion of phenols to cyclohexanes, and aromatics to lighter boiling naphthalenes. At Billingham we have kept this petrol production to a minimum by careful attention to the design of the converter internals to ensure accurate temperature regulation. It has consequently been unnecessary to distil petrol from the crude "saturation stage" product before subjecting it to the second stage treatment. The final total petrol has not been appreciably inferior in knock rating to that which could have been made in the second stage from saturated middle oil alone. In Germany, the same success in minimising splitting in the saturation stage was not achieved, and the crude product frequently contained about 30 per cent of petrol with a relatively low knock rating. It was therefore customary to distil off petrol from the crude saturation product, and so treat only the middle oil in the second step.

An advantage of this two-stage process is that by controlling the amount of hydrogen added at the first, or saturation stage, it is possible to control the knock rating of the product of the second stage. The more hydrogen is added at the first stage, the lower the knock rating of the product from the second stage. The limit of this flexibility is the minimum hydrogenation necessary in the first stage to ensure absence of nitrogen.

The use of this two-stage process enabled the Billingham blend to meet the No. 1 Grade Specification for motor fuel in force up to the outbreak of the war, which demanded an octane number of 75, as determined by the CFR Motor Method. Still further improvements in specification were contemplated at that time which led us to give attention to catalysts to give still further improved results. Success was achieved with new catalysts for the second stage of the two-stage process in which the very active hydrogenating component tungsten sulphide was replaced by less active elements. In the preferred catalyst the tungsten was replaced by iron. The catalyst (231) enabled motor fuel with a clear octane number of 78 to 80 to be made. Its greatest importance was for the manufacture of aviation fuel. This advance, which was worked out entirely at Billingham, was a step of equal importance to the others which have been described.

Table V shows a comparison of the operation of these vapour-phase hydrogenation catalysts. Four examples are given:

(a) The single-stage operation with tung-

TABLE IX.

TYPICAL FULL-SCALE OPERATING CONDITIONS AND YIELDS FOR VAPOUR-PHASE HYDROGENATION OF CREOSOTE MIDDLE OIL.

Process	(a) Single stage petrol production	(b) Saturation stage 2-stage process	(c) Splitting stage 2-stage process	(d) Splitting stage 2-stage process
Catalyst	5058	5058	6434	231
Petrol made	Premium grade motor spirit 45 per cent. vol. at 100° C.	Feed for (c) and (d)	Premium grade motor spirit 45 per cent. vol. at 100° C.	Base spirit for 100 octane fuel 72 per cent. vol. at 100° C.
Make-up feed rate, tons m³ catalyst hour	0.59	1.2	0.85	0.55
Total oil feed rate to hydrogenation stall, tons m³ catalyst hour	1.1	1.2	1.3	1.0
Vaporising gas rate, m³ ton total oil fed	2000	2800	1600	1700
Cooling gas rate, m³ ton total oil fed ...	1700	1900	900	850
Vol. per cent. hydrogen in inlet gas ...	85	87	83	86.5
Vol. per cent. hydrogen in exit gas ...	82.5	85	80	85.8
Total pressure inlet converter, atmospheres	256	256	256	256
Total pressure exit converter, atmospheres	249	249	249	249
Average reaction temperature °C. (with medium age catalyst)	420	385	400	370
Pass conversion of middle oil	54%	100%	65%	55%
Petrol yield wt. per cent. middle oil converted :—				
butane free	86.5	—	88.5	75.0
butane	3.5	—	3.5	0.5
total	90.0	100	92.0	75.5
Total hydrocarbon gas yield, incl. C_4 in petrol, wt. per cent. of middle oil converted	16.8	1.5	13.0	27.5
H_2 chemical absorbed, wt. per cent. middle oil converted	8.4	5.1	3.0	3.5
Total hydrogen used, wt. per cent. middle oil converted	8.8	5.5	3.4	4.2

sten sulphide catalyst as practised at Billingham in the first years of operation.

(b) Saturation stage operation with the same catalyst, as practised in recent years.

(c) Splitting stage operation with 6434 catalyst for motor spirit production, as used up to the start of the war.

(d) Splitting stage operation with our new catalyst, 231, for aviation base production.

In comparing (c) or (d) with (a), it must be remembered that the hydrogen consumption and gas yields in (b) must be added to (c) and (d).

Fig. 8 gives a flow diagram of the two-stage vapour phase hydrogenation process. In this diagram attention should be drawn to the arrangements for cooling during reaction. It is essential that during the hydrogenation process the temperature should be controlled between the limits of approximately 20° C. All hydrogenation reactions are exothermic, and therefore, if no provision is made for removal of heat, the temperature inside the reactor will rise at a progressively increasing rate due to the positive temperature coefficient of the reaction. This instability of the system is accentuated by the fact that, as temperatures increase, more extensive hydrogenation breakdown to lower molecular weight products occurs—ultimately creosote is converted entirely into methane—and the heat of reaction associated with a given amount of creosote increases correspondingly. This is shown in Table X.

The method now generally used for controlling temperature of vapour-phase reactions was worked out in the first place at Billingham, and comprises a division of the reaction space into numerous sections. Between each two sections the vapours are mixed with cold gas and redistributed over

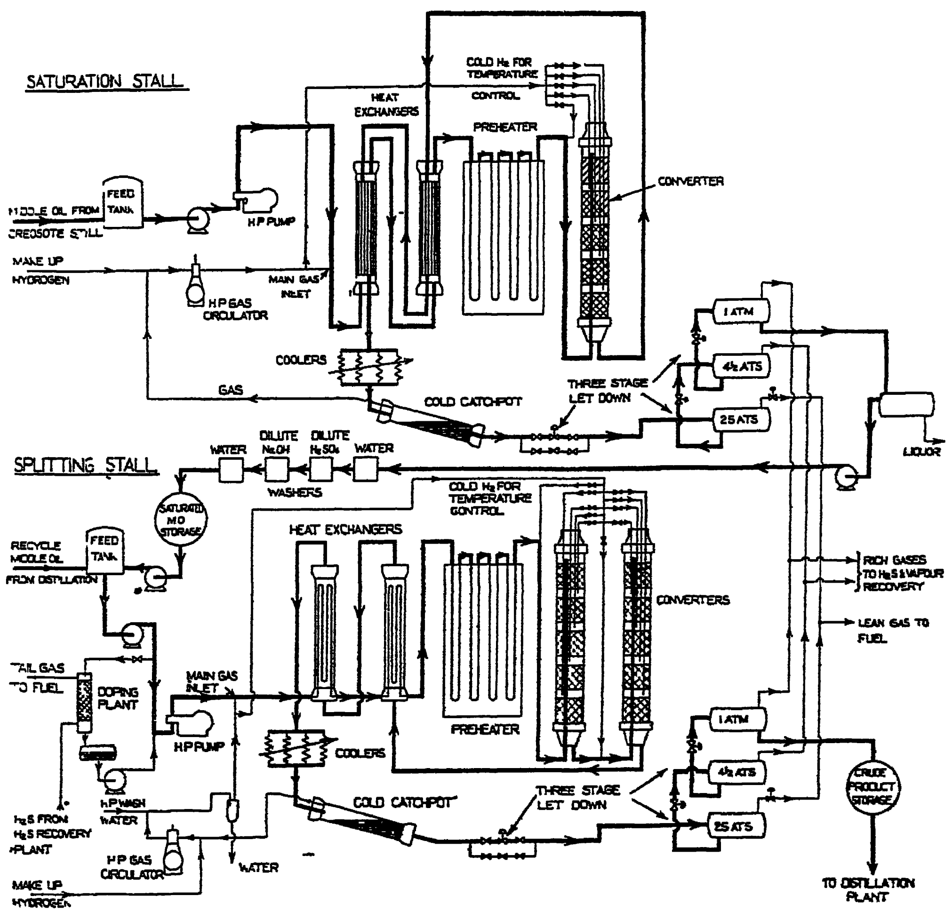

Fig. 8. Vapour-phase hydrogenation stalls.

the next batch of catalyst. Very careful design is needed for this part of the equipment. Fig. 9 is a plot of temperatures through the whole of the two-converter system, and this shows how the cooling gas streams are utilised to maintain the temperature between the proper limits. If temperatures are allowed to get out of hand, highly exothermic reactions supervene. Temperatures soon reach a dangerous point, and only a quick release of pressure will avoid dangerous conditions.

TABLE X.

1 ton creosote + 0.078 tons hydrogen — 0.92 tons commercial motor petrol
— 0.08 tons butane
— 0.025 tons other hydrocarbon gases
— 540 ton calories

1 ton creosote + 0.086 tons hydrogen — 0.85 tons aviation petrol
— 0.21 tons butane
— 0.080 tons other hydrocarbon gases
— 590 ton calories

1 ton creosote + 0.213 tons hydrogen — 1.17 tons methane
+ 1240 ton calories

In the case of the Heysham plant there was an interesting development in the design of the saturation stage of the vapour phase process. The oil to be used demanded a much lower reaction temperature and a lower contact time than is found necessary with creosote, and, moreover, had a higher average boiling range. To ensure its complete vaporisation, excessive pipeline sizes would have been needed to carry the gas. After the necessary experimental work had been done it was decided to carry out the saturation stage largely in the liquid phase. A special converter design was produced for this purpose following the same principles as in the vapour-phase unit. It was necessary to ensure not only distribution of the vaporised oil over each bed of catalyst, but also even distribution of the part remaining as liquid.

It has been mentioned earlier that the reaction temperature required in the splitting stage of the two-stage vapour phase process is lower than that needed with 5058 in a single treatment, which in turn is considerably lower than the temperature used in the early days with molybdenum catalysts.

A valuable result attending this reduction of splitting reaction temperature is that the formation of methane and ethane is almost entirely avoided. Nearly all the gaseous products are the more valuable propane and butane. An interesting point is that a high proportion—between 70 and 75 per cent—of the butane formed is iso-butane. This proportion, and also the proportion of propane and butane in the gaseous product, appears

TABLE XI.

EFFECT OF VARIATION IN EXTENT OF HYDROGENATION ON PETROL AND HYDROCARBON GAS YIELDS.

Raw material: Creosote middle oil.
Process: 5058 saturation followed by 6434 or 231 splitting.

Petrol volatility :— Vol. per cent. at 100° C. ...	35	45	55	72
Petrol, F.B.P. ...	200° C.	180° C.	160° C.	133° C.
Yields, per cent. wt. creosote middle oil :—				
Butane free petrol	92.0	88.5	84.5	75.0
Butane	8.0	11.5	15.0	21.0
Propane	2.0	2.5	3.0	4.0
Methane, ethane and analytical errors	0.5	0.5	1.0	4.0
Total hydrocarbon gas	10.5	14.5	19.0	29.0
Hydrogen consumption :— per cent. by wt. of middle oil ...	8.4	8.8	9.2	9.7

to be substantially independent of the nature of the feedstock. By changing the end point of the petrol fraction made, it is possible to vary the proportion of butane made between wide limits, as is shown in Table XI.

The small diminution with increasing volatility in the total production of petrol plus

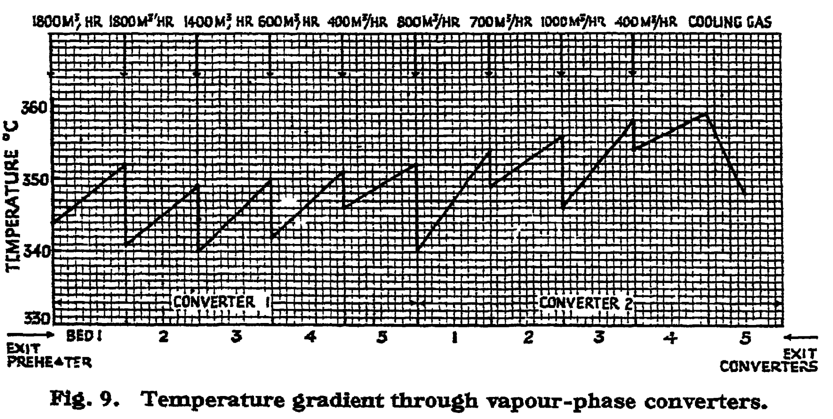

Fig. 9. Temperature gradient through vapour-phase converters.

butane will be noted. With the development of a process for he dehydrogenation or butane to butylene, a relatively high proportion of iso-octane can be made for blending with the base petrol to 100 octane number fuel. The high proportion of isobutane in the C_4 fraction is advantageous in this connection for the manufacture of iso-octane either by the alkylation process or by polymerisation followed by hydrogenation.

A hydrogenation classification of the vapour phase hydrogenation products from creosote oil, made with various catalysts, is indicated in Table XII. Table XIII gives a hydrocarbon analysis of two base petrols for aviation fuels, the first made from creosote and the second from a suitable gas oil. The high proportions of iso-pentane, methyl cyclopentane and methyl cyclohexane will be observed. The very high knock ratings of the fuels will be noted. They are both similar as regards weak mixture ratings, but on rich mixture ratings the high aromatic content of the petrol made from creosote gives it an advantage.

The crude hydrogenation product must be stored in tanks from which air is excluded so as to avoid oxidation of the H_2S content to elemental sulphur. The general practice is to connect the top of the tanks used for storing the crude material to the gasholder containing the rich gas. The pressure from hydrogenation products is released in three stages so as to concentrate the higher molecular weight gaseous fractions in the last stage in order that the gas from the earlier

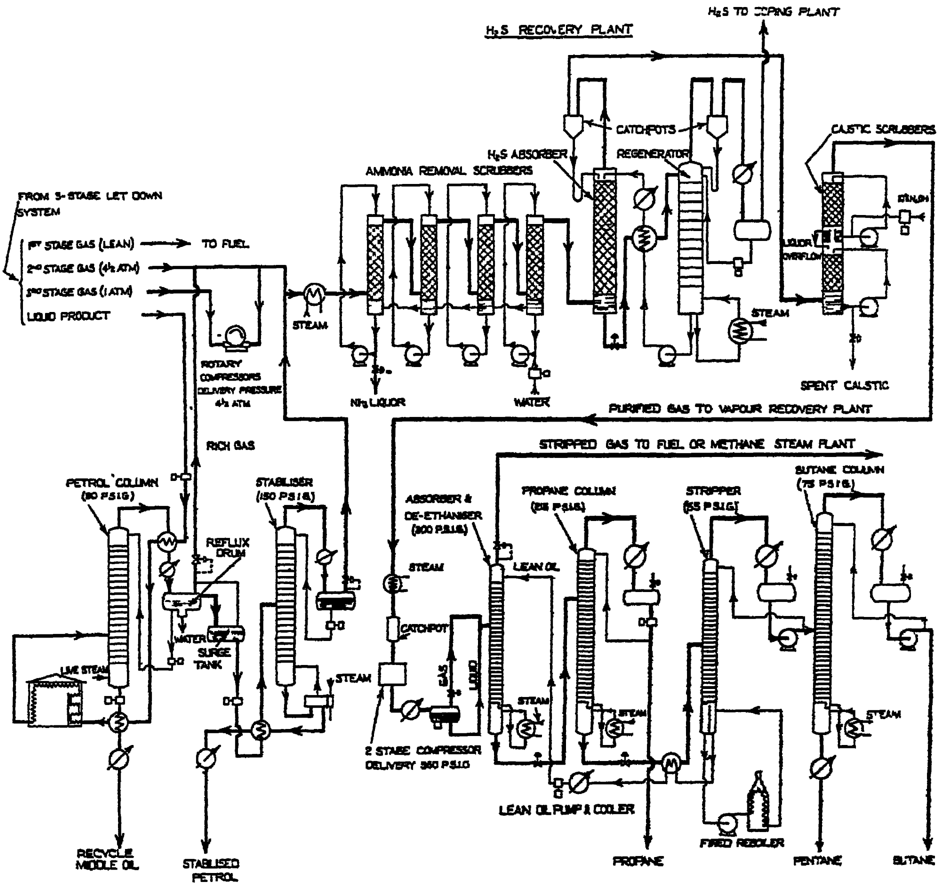

Fig. 10. Product distillation and light hydrocarbon and hydrogen sulphide recovery plants.

stages can be used as fuel directly without loss of valuable components. Fig. 10 is a flow diagram of the plant in use at Billingham for distilling the hydrogenation product and recovering the hydrocarbon gases.

TABLE XII.

COMPOSITION OF MOTOR PETROLS OBTAINABLE FROM CREOSOTE MIDDLE OIL USING VARIOUS HYDROGENATION CATALYSTS.

Process Catalyst	Single stage 64	Single stage 5058	2-stage 5058 saturation. 6434 splitting	2-stage 5058 saturation. 231 splitting
Petrol composition, vol. per cent.—				
Aromatics	43	3	7	15
Naphthenes ...	33	50	54	48
Branched chain paraffins	7	31	33	32
Straight chain paraffins	14	16	6	5
Unsaturated hydrocarbons	3	Nil	Nil	Nil
C.F.R. motor method octane number ...	80	68	75	77

It will be seen that the liquid product goes into a conventional flash-heated distillation column, and that the overheads from this column go to a stabiliser which is controlled to give petrol of the correct vapour pressure. The overheads from the stabiliser join the gases from the last two stages of the let-down system. The gas is first of all washed with water to remove ammonia, which comes from the nitrogen in the oil, and is then scrubbed with alkacid liquor for recovery of H_2S. The H_2S is used for saturating the feed to the vapour-phase stalls in order to maintain catalyst activity.

The gas is given a final purification in a caustic scrubber, and is then compressed to 360 lb. before going to the plant for recovery of gaseous hydrocarbons. The gas is asorbed in oil in a column designed to act both as absorber and de-ethaniser. From the oil, propane is taken overhead in the next column, and the other gaseous products in the third column. Finally, butane is separated from pentanes, the latter being blended in the petrol.

If any new hydrogenation plants are built, it would probably be preferable to run stabilisation units directly in conjunction with the hydrogenation units, since vapour-phase hydrogenation units are so reliable in operation that it is now regarded as unnecessary to interpose storage between the hydrogenation and separation units. Vapour-phase petrol normally requires nothing more than a caustic wash to free it from the last traces of H_2S. In some cases it has been found necessary to add hypochlorite treatment to remove traces of mercaptans which are synthesised in the hydrogenation reaction on account of the presence of H_2S.

In the original Billingham layout the liquid-phase product was separated into gas, petrol, an intermediate boiling range naphtha containing tar acids, middle oil and heavy oil. The petrol obtained directly from coal requires acid treatment. In the German plants this separate treatment of the liquid-phase petrol was avoided by putting the product together with middle oil through the vapour-phase converters so that the liquid-phase petrol was in effect refined by hydrogenation. It is probable that this arrangement is more economical.

Reference has already been made to the substantial quantity of phenol, cresol and other homologues resulting from coal hydrogenation. Plant was installed in 1937 for the recovery of these materials. A suitable naphtha fraction cut to contain the phenols was washed with caustic soda in orifice columns to give sodium phenates. The separated phenate solution was then stripped of neutral oils in a fractionation column. The purified phenate was then "sprung" by

TABLE XIII.

PROPERTIES OF 231 BASE PETROLS FOR 100 OCTANE FUEL.

Feedstock	Creosote	Naphthenic type petroleum gas oil
Composition of feedstock—		
Vol. per cent. aromatics ...	Substantially 100 per cent.	20
Vol. per cent. naphthenes ...	—	65
Vol. per cent. paraffins ...	—	15
Petrol properties		
Specific gravity	0.73	0.705
Distillate recoverable at—		
75° C.	33	42
100° C.	70	72
110° C.	82	88
FBP° C.	133	135
Vol. per cent. aromatics ...	12	5
Vol. per cent. naphthenes	42	30
Vol. per cent. paraffins ...	46	65
Content of individual hydrocarbons, vol. per cent.—		
Benzene	4.0	1.0
Toluene	5.0	3.0
Xylene/ethyl benzene ...	3.0	1.0
Cyclopentane	1.0	0.5
Methyl cyclopentane ...	13.0	7.0
Cyclohexane	2.5	1.0
Dimethyl cyclopentane ...	6.0	5.0
Methyl cyclohexane ...	11.0	9.0
Dimethyl cyclohexanes, etc.	8.0	7.0
Isopentane	17.0	22.0
N-pentane	2.5	2.5
Methylpentanes	10.5	13.5
N-hexane	2.0	2.5
Methyl hexanes	5.5	10.0
N-heptane	0.2	0.5
Dimethyl hexanes ...	1.5	2.5
Methyl heptanes	2.0	5.0
N-octane	0.2	0.5
C.F.R. motor method octane number—	79.0	77.0
+ 4.8 c.c. TEL/gallon ...	93.5	93.5
+ 5.5 c.c. TEL/gallon ...	94.5	94.5
3C Rich rating (per cent. of rating of S + 1.25 c.c. TEL/US gallon) of petrol leaded with—		
4.8 c.c./TEL/gallon ...	96.0	82.0
5.5 c.c./TEL/gallon ...	99.0	85.0

CO_2, and the crude phenols separating were further worked up by distillation in a batch column to phenol and various grades of cresol. Fig. 11 is a diagram of this plant.

It was early recognised that the good knock rating of hydropetrol, combined with its high lead susceptibility due to the absence of sulphur compounds, made it a suitable material for aviation fuel. The first product made at Billingham was 87 octane number fuel, which was, in the first place, a straight product from single-stage hydrogenation of coal middle oil and creosote, cut to about 55 per cent volatility. The introduction of the two-stage vapour phase process with catalyst 6434 made it easier to reach the desired specification, since the lead requirement was below the maximum.

Attention was focussed very early on the desirability of the manufacture of 100 octane fuel, preferably from coal. The butane fraction was rich in iso-butane and was an obvious starting-point for the synthesis of iso-octane. A process was worked out at Billingham in 1935-36. The first step necessary is the dehydrogenation of the iso-butane to isobutene, and this was in the first place carried out by thermal cracking with which a moderate yield is obtained. Although it was clear that a practical process could be worked out in this way, the relatively low yield from thermal cracking, combined with the high cost due to the limited amount of butane at Billingham, ruled out practical development. An obvious improvement would be a process for the catalytic dehydrogenation of butane so that high yields of butylene could be obtained.

At about this time a chromium aluminium catalyst for this step was invented by the Shell Development Company, and the process was worked on by the Universal Oil Products Company, with whom we collaborated from an early stage. Experiments were carried out by them at Riverside, near Chicago, and shortly before the outbreak of the war a practical scheme was put forward. A plant for the manufacture of 10,000 tons a year of iso-octane was approved by I.C.I. in the early part of 1939. The process is illustrated in Fig. 12.

The liquid butane feed passes to the dehydrogenation furnace, where it is first preheated in a convection bank. It then flows into one of two reactor banks where catalytic dehydrogenation takes place, represented by the equation:

$$C_4H_{10} \longrightarrow C_4H_8 + H_2 \longrightarrow 29{,}000 \text{ cal.}$$

The reaction takes place in special steel tubes 2-in. in diameter filled with pelleted

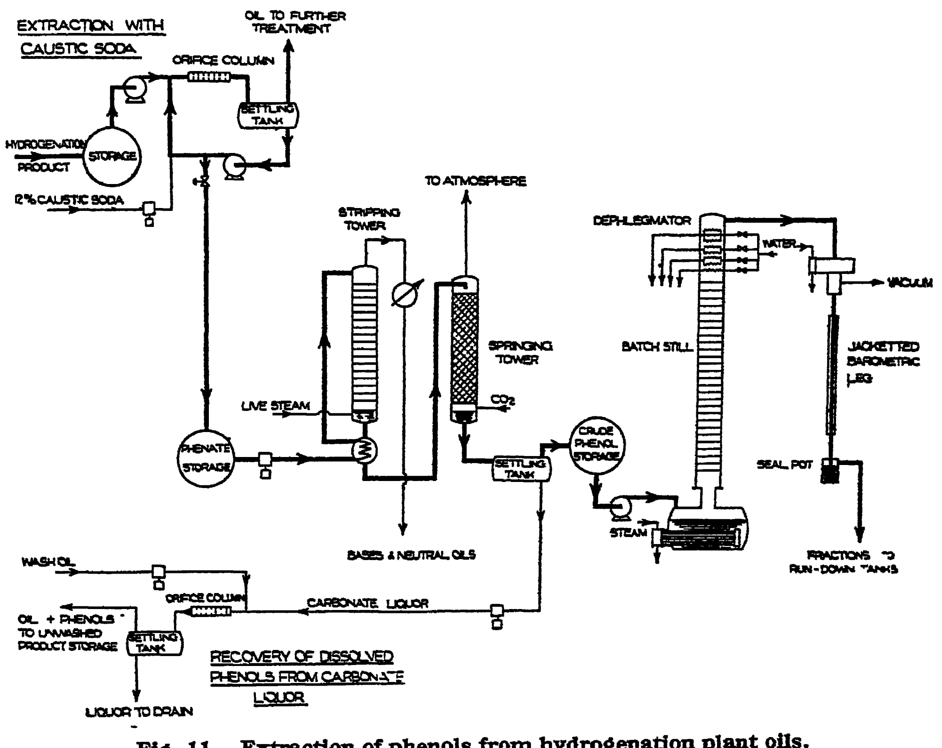

Fig. 11. Extraction of phenols from hydrogenation plant oils.

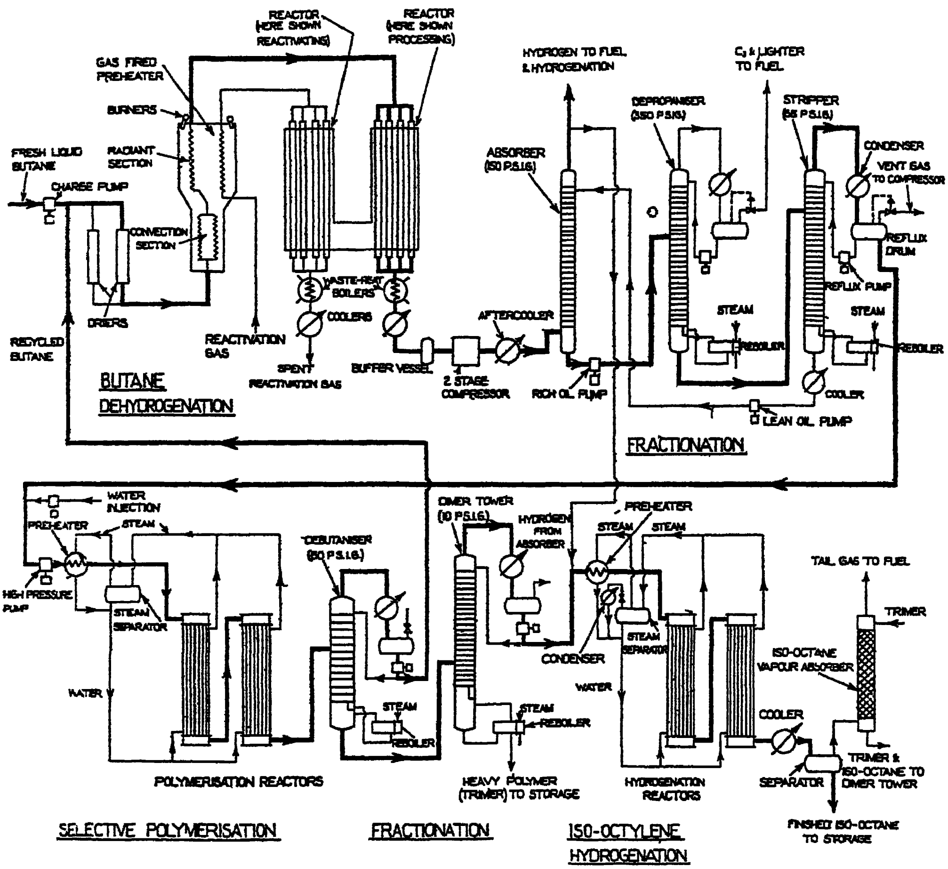

Fig. 12. Iso-octane plant.

catalyst. A conversion of approximately 25 per cent per pass is obtained, which nearly corresponds to equilibrium at the dehydro genation temperature of 550°C. to 575°C.

During the processing, the pelleted catalyst in the reactor becomes coated with carbon, and after a period of approximately an hour it is necessary to remove this carbon by combustion with gas containing a limited amount of oxygen; this step is called reactivation. The gas stream is, therefore, switched from one reactor to another at regular intervals, and whilst one reactor is processing, the other is being reactivated. The reaction product, after cooling, is compressed and the C_4 hydrocarbons separated from the hydrogen and lighter hydrocarbons formed by absorption with oil. The rich oil is depropanised and then debutanised.

The C_4 fraction passes through tubular polymerisation reactors filled with catalyst of phosphoric acid on kieselguhr, where practically the whole of the butylenes present polymerise to give dimer and trimer. These are freed from the residual butanes in a stabilising column, and the butanes are recycled to dehydrogenation. The dimer and trimer are separated by distillation, and the former is hydrogenated over a nickel catalyst with the hydrogen separated from the dehydrogenation product.

A considerable improvement in this process was made by the discovery of an improved dehydrogenation catalyst by I.C.I. in the early days of the war which has given not only very regular running but a considerably greater output and yield. Operating conditions for this process are shown in Table XIV.

To make 100 octane number fuel, this iso-octane is blended with about three times its weight of vapour-phase petrol. An obvious economy in the process would have been to replace the polymerisation and hydrogenation steps by alkylation. The

high ratio of isobutane to normal butane would have made this specially attractive. Dehydrogenation would have been necessary for only half the butane, and the product alkylated with isobutane. The alkylation process was unfortunately not fully developed at the time when a decision had to be taken. The process adopted has the advantage of giving a superior quality product.

TABLE XIV.

TYPICAL OPERATING DATA FOR ISO-OCTANE PLANT.

DEHYDROGENATION SECTION (Catalyst volume 3.6 m^3 in each reactor.)

Process conditions—	
Fresh feed	50 te/day (69.9 per cent. wt. isobutane, 28.6 per cent. n-butane, 1.5 per cent. propane).
Recycle feed ...	141 te/day (from polymerisation section).
Pressure	Inlet—6 atmospheres.
Temperatures ...	Inlet 550° to 575° C.; exit 530° to 560° C.
Process period ...	1 to 1½ hours.
Olefines in feed to polymerisation ...	24.0 mol. per cent.
Reactivation conditions—	
Reactivation gas ...	5000 m^3/hour (2½ per cent. oxygen).
Pressure	Inlet—7 atm.; Exit—3 atm.
Temperature ...	Inlet, 500° C.
Time required to burn off carbon	Approx. 25 minutes.
Total time on reactivation	Same as process period.

POLYMERISATION SECTION.

Catalyst volume ...	3.2 m^3 in each reactor.
Pressure	Inlet, approx. 55 atmospheres.
Temperature ...	140° C. to 170° C.
Olefines in recycle butanes	3 mol. per cent.

HYDROGENATION SECTION.

Catalyst volume ...	0.5 m^3 in each reactor.
Ratio of inlet gas to feed	400 m^3/te.
Pressure	Inlet, 7½ atmospheres.
Temperature ...	150° C. to 185° C.

OVERALL BALANCE (Weight per cent.)

In fresh feed	butane	100.0	*Out*	iso-octane	78.5
	propane	1.5		trimer	3.7
				carbon	0.8
				gas	11.8
				loss	6.7
	Total	101.5			101.5

PROPERTIES OF ISO-OCTANE.

Specific gravity (15°/15°C.)		0.713
Distillation	Initial B.P.	57° C.
	5 per cent. vol. at ...	100° C.
	50 per cent. vol. at	108° C.
	95 per cent. vol. at	146° C.
	Final B.P.	172° C.
Bromine number (McIlhiney)		>1
Reid vapour pressure		4 lb./sq. in.

Engine ratings (blending values in blend of 25 wt. per cent. iso-octane and 75 per cent. hydropetrol; plus 4.8 c.c. TEL per Imperial gallon):—

Weak (CFR motor method) ...	110
Rich (per cent. "S+1.25") ...	123

Alkylated benzenes are valuable aviation spirit components. They do not enhance the weak mixture rating to the extent that is done by octanes, but they do have a very marked effect indeed on the rich mixture ratings. Some work in this field was done in connection with aviation fuel work in 1935 and 1936 at Billingham. In 1943 the demand for rich mixture components was very great, and after some experimental work it was decided to replace to a large extent at least the iso-octane manufacture at Billingham by the production of butyl benzene to which the appropriate code name "Victane" was given. Butyl benzene was for all practical purposes the equivalent of cumene (isopropyl benzene) which was made on such a large scale in the U.S.A. for the same purpose. The process of manufacture is very similar.

TABLE XV.

TYPICAL OPERATING DATA FOR VICTANE PLANT.

Catalyst volume ...	9.35 m^3.
Converter pressures ...	Inlet 53 atm., exit 50 atm.
Converter temperatures	Inlet 263° C., exit 260° C. average, 263° C.

Feed	tonnes/hour	tonnes/hour
Isobutylene	1.48	—
N-butylene	0.67	—
Butanes	6.45	—
Total		8.6
Water		0.02
Recycle benzole	15.8	—
Make-up benzole	2.8	—
		18.6
Total		27.22
Products		
Victane (butyl benzene) ...	4.1	—
Victane bottoms	0.2	—
Butanes	6.45	—
Olefines	0.15	—
Recycle benzol	15.8	—
Purge and loss	0.52	—
Total		27.22

Conversion—	
of olefins	92.4 per cent.
of isobutylene	93.7 per cent.
Properties of Victane—	
Specific gravity (15°/15° C.)	0.859
Distillation	
Initial B.P.	110° C.
5 per cent. vol. at ...	130° C.
50 per cent. vol. at ...	164° C.
95 per cent. vol. at ...	169° C.
Final B.P.	176° C.

Engine ratings
(blending values in blend of 12 wt. per cent. Victane and 88 wt. per cent. hydropetrol; plus 5.5 c.c. TEL per Imperial gallon)

Weak (C.F.R. motor method)	105
Rich (per cent. "S+1.25") ...	159

At Billingham the butane/butylene stream from the dehydrogenation plant was pumped into one of the hydrogenation converters together with excess of benzene, which had been purified by hydrogenation. Phosphoric acid on kieselguhr was used as the catalyst. To maintain catalyst activity, a definite proportion of water must be introduced with the feed. The crude reaction product was separated by distillation into recycle butanes, unconverted benzene, butyl benzene and heavier alkylates. The residual

butane/butylene fraction passed through the polymerisation reactors and produced a small quantity of iso-octane. A flow diagram of the process is shown in Fig. 13. and the operating conditions are shown in Table XV.

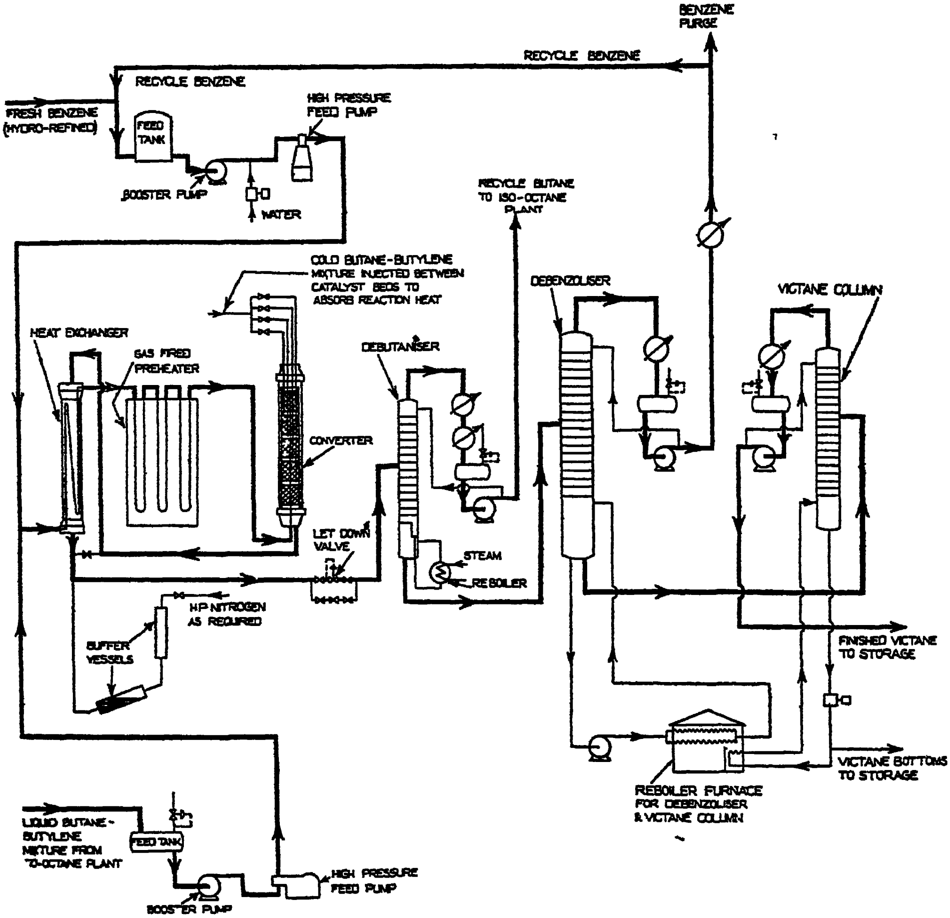

Fig. 13. Victane manufacture.

PHENOTHIAZINE IN PEST CONTROL

Long known as a chemical compound for the control of internal parasites in a variety of animals, phenothiazine, according to E.I. Du Pont de Nemours & Co., has found a new field of economic usefuluness, as an insecticide for the control of the codling moth. Combined with lead arsenate, Du Pont's agricultural grade of phenothiazine, in numerous experiments and demonstrations undertaken in Pennsylvania, Virginia, West Virginia, Maryland, Delaware, and New Jersey, has revealed outstanding control of the codling moth. At the present time tests are also being made in New York and other apple-growing States, where interest in the new combination spray is high.

A new method for the manufacture of turpentine has been announced by the United States Department of Agriculture. It is reported to be cheaper and speedier than the so-called batch method used at present. Preheated gum from pine trees is put in a continuous steam still of novel construction, which yields turpentine and rosin. The end-products are said to be better than those produced by conventional methods.

British Association of Chemists

Political Fund to be put into Operation

Mr. Norman Sheldon.

THE British Association of Chemists is to put a political fund into active operation as a result of a decision made at the 29th annual general meeting at the Adelphi Hotel, Liverpool, on December 7, following a resolution put forward by the Manchester Section.

During the discussion it was urged that it was an advantage to have a fund from which chemists of all political parties might receive assistance when seeking election on public bodies. There would be no suggestion of assisting any particular party. The object was to assists chemists to play their part in public affairs, and to let them feel that they had the goodwill of their fellows. The hon. secretary, Mr. J. Stewart Cook, pointed out that the officers for the coming year included a president who was a Conservative borough councillor, an hon. secretary who was Labour, and a vice-president who was a Liberal. The Association did include all parties, and it was likely that they would see fair-play.

The retiring president, Professor R. G. W. Norrish, D.Sc., F.R.I.C., F.R.S., was in the chair. After the adoption of the treasurer's report and the report of Council, Professor Norrish presented the Hinchley Medal to Mr. C. S. Garland, B.Sc., A.R.C.S., F.R.I.C., M.I.Chem.E., and in doing so paid tribute to the work which Mr. Garland had done for the association over a long period of years. He referred to the affection with which Mr. Garland was regarded as one of the founder members, and to the way in which he had made his influence felt among employers and employees alike. His pioneer work, in many directions, was of great value to the profession. Mr. Garland thanked the meeting for the honour he had received, and for the generous terms in which the president had referred to him. He spoke of his affection for Professor Hinchley and said how proud he was to have a medal which bears his name. He wished the association success in its work, and said that it had a valuable function to perform for chemists.

The New Officers

Officers for the ensuing year were elected as follows: *President*, Mr. Norman Sheldon, A.R.C.S., F.R.I.C.; *vice-presidents*: Professor R. G. W. Norrish, D.Sc., F.R.I.C., F.R.S.; Dr. J. B. Matthews, B.Sc., Ph.D.; Mr. J. Wilson, M.C., M.Sc., M.I.R.I., F.R.I.C.; Mr. C. A. Wylie; *hon. secretary*, Mr. J. Stewart Cook, B.Sc., A.R.C.S., A.R.I.C.; *hon. treasurer*, Mr. W. C. Peck, M.Sc., F.R.I.C., A.M.I.Mech.E., M.I.Chem.E.; *hon. registrar*, Mr. H. L. Howard, B.Sc., A.R.C.S., F.R.I.C., M.I.Chem.E., D.I.C.; *hon. editor*, Mr. T. Crosbie Walsh, F.R.I.C.; *trustees*: Dr. P. Haas, Ph.D., D.Sc., Mr. F. Scholefield, M.Sc., F.R.I.C., Mr. C. A. Wylie; *general councillors*: Mr. D. Jackson, B.Sc., A.R.C.S., Mr. A. J. Mills, A.C.G.F.C., A.R.I.C., Mrs. S. M. I. Tritton, F.R.I.C., M.P.S., Mr. J. Wilson, M.C., M.Sc., M.I.R.I., F.R.I.C.

Professor Norrish spoke of the work of the association during the past year, and reminded the audience that the association fulfils a very important function, not fulfilled by any other body. The association claims to speak for the chemical profession on all matters concerning the employment and the economic interests of chemists. In order to do this more efficiently, the association must be developed by the recruitment of the right type of members, and must work in collaboration with other bodies, such as the Royal Institute of Chemistry and the Association of Scientific Workers.

Introducing Mr. Norman Sheldon as the new president, Professor Norrish paid tribute to his energetic work for the association in the past, commending him as a keen, vigorous business man, and as a leader. The election of Mr. Sheldon was greeted by the members with hearty and prolonged applause.

Two proposed alterations to the rules were adopted. One gave authority to increase benefits, under the Employment Benefit Fund, and the other established the office of honorary life vice-president. Professor E. C. C. Baly, C.B.E., F.R.S., was elected to that office in recognition of the valuable work he had done for the association during the past years.

At the close, Mr. Sheldon paid tribute to the work of Professor Norrish, who had been president during a very difficult time.

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He expressed the thanks of the association for the very sincere hard work which Professor Norrish had performed in their interests, and moved a hearty vote of thanks, which was accorded with enthusiasm.

Statement of Policy

Mr. Sheldon has issued the following "Statement of Policy":

In assuming the office of president of the British Association of Chemists, I would like to make known to British chemists the policy for which the association stands and which it is my duty and pleasure to uphold. The British Association of Chemists is not, nor does it pretend to be, a qualifying body, but it is the only organisation which exists for the sole purpose of looking after the economic interests of the chemical profession.

We seek to strengthen the individuality of our members by giving financial support when seeking new employment. We do this by means of our Unemployment Benefit Fund, which has a reserve of over £42,000, and which has paid out many thousands of pounds to members in order that they may not be forced to accept employment with inadequate remuneration or unsatisfactory conditions of service. We are exploring the possibility of setting up a superannuation scheme, which will be transferable when a member moves from one firm to another, and we hope to extend our unemployment benefit scheme to cover loss of income through sickness or accident and to pay an income for life to those who may be so unfortunate as to become totally and permanently disabled. To those desiring a change of employment we provide a comprehensive appointments service.

Official Recognition

We believe that professional men should combine in this way in order to supplement the meagre benefits offered by State insurance. Such a financial background would enable our younger members to plan their careers with confidence, strengthened by the knowledge that if they did meet with difficulties they would not be crippled financially. It is our intention to pursue with the utmost vigour a policy leading to the official recognition of the association by industrial firms, Government departments, and public authorities as the appropriate body with whom all matters relating to the economic interests and the status of chemists should be discussed.

In order that some of these functions may be performed more efficiently and with the assistance and co-operation of Government departments, we are registered as a trade union. Let it not be thought, however, that this means that we are in any way associated with any particular political party, for we have set our face resolutely against any bias of a party character. We believe that our members are entitled to play their part as individuals in the field of public affairs, and we should encourage them to do so, but as a body we believe that it would be wrong to be associated with any political propaganda of a party character. One of the most important of our activities is the formation of student groups through which students of chemistry can take an interest in matters concerning their present and future economic welfare and secure the co-operation and advice of the senior members. We can assist students who may be seeking financial aid from Government departments in order to continue their studies.

We seek to co-operate with all other organisations who may be concerned with the problems in which we are interested and invite all members of the chemical profession to join the association and play their part in the many vital issues which will face us during the next few years.

U.K. Steel Output

Record Figures for November

THE production of steel in the U.K. during November was at the highest rate reached in any month this year. Output was 1,055,000 tons for the four weeks, a rate of 13,715,000 tons a year, compared with 990,000 tons, or annual rate of 12,870,000 tons for November, 1945. The output was greatly in excess of November, 1938, the last pre-war year, when the rate was 10,320,000 tons a year.

Pig-iron output during the four weeks of November was 615,000 tons, a rate of 7,903,000 tons a year, compared with 600,000 tons, or an annual rate of 7,801,000 tons for the same month last year. The pig-iron figures were slightly reduced by a temporary interruption to production at one of the works. Figures given in the tables below represent tons.

Steel Ingots and Castings

	Weekly Average 1945	1946
First quarter ...	233,200	242,600
Second quarter ...	227,200	252,100
Third quarter ...	132,600	146,600
October	243,200	254,300
November	247,500	263,800

Pig Iron

	Weekly Average 1945	1946
First quarter ..	134,500	145,500
Second quarter ...	132,600	150,500
Third quarter ...	132,600	146,600
October	146,100	155,800
November	150,000	153,900

MANAGEMENT PROBLEMS

In order to assist subscribers in the solution of their management problems we invite questions relating to such matters as accounting, costing, control of plant and materials, office methods, income tax, etc. Correspondents will be answered under initials but should give their names and addresses which will not be published, and when documents of any kind are sent to us they should be copies only, as they cannot be returned. Letters should be addressed to the Editor.

Query.—" We have two manufacturing sections, one producing the crude material and the other using this material for the manufacture of pure products. The question frequently arises as to whether crude transferred to the purifying plant should be calculated at cost price or market price. Can you help us to decide this point?—H.B. & S.

Reply.—When a single product is manufactured, the calculation of the unit cost is relatively simple, but when there are a number of products of different market value it is difficult to estimate the proportion of labour, fuel, etc., used in the production of each quality. Comparative costs are usually compiled on the basis of each unit of raw material, and the raw products transferred at market prices, but so long as the bearing of the system is borne in mind it matters very little in practice.

Buying Department

Query.—" Apart from the restricted supply of materials the need for ready money to satisfy local creditors compels me to limit my trade purchases. However, I propose to acquire more stock, and a little advice on the organisation of the buying department would be useful."—A.C.M.

Reply.—It should never be forgotten that a small turnover will absorb much more capital, relatively speaking, than will a large turnover. Unless, therefore, there are urgent reasons for adopting such a course, stocks should never be permitted to dwindle below that minimum which experience has proved advisable to carry. When the number, weight or quantity under any heading threatens to reach the minimum, it is a good practice to make an entry in a book kept for that purpose. This book may be provided with columns or sections for the insertion of such details as the date, a description of the materials or stores required (including the quantity) and for any special observations or remarks, but, of course, the precise ruling will depend on the size of the business and the class of trade. If a separate section is provided for office use, this section may comprise columns for showing the date on which each order was given out, the name of the supplier, the date on which the goods or articles arrived on the premises, and any other essential information. Each order form should be signed, and it should be made quite clear to suppliers that any deviation from the particulars will be entirely at their own risk. Sometimes it will be advisable to state the latest date for delivery, or the terms and conditions. When dealing with a firm of suppliers for the first time a special effort should be made to avoid misunderstandings. The invoices received should be stamped by means of a rubber stamp or other suitable impression, and should be carefully checked as to price and discount before making any entry in the purchases journal or bought day book.

Costing in Research

Query.—" As a research worker, I should be interested to know if you think that accounts compiled by the costing department are really of greater value than estimates of expenditure from laboratory conditions."—T.J.

Reply.—As cost accounts show the cost of manufacturing a particular product on a scale of process expenditure which has already been in actual operation, and as they embody charges and items that cannot always be foreseen under laboratory conditions, the costing department is of great value in research and can often indicate material economies in the use of by-products. The careless use of raw materials will often send up costs, and this is not always allowed for in the laboratory. Moreover, the application of a costing system can exert a great moral influence on the staff, and this is important.

Contingencies

Query.—" When our next stocktaking comes round we intend to make the fullest possible provision we can against such contingencies as bad debts, discounts, repairs, and maintenance of plant and equipment, etc. Could you outline the customary procedure and indicate some of the book work this would entail?"—G. & T.

Rely.—Provision against book debts that are uncertain of collection can be made by calculating a certain percentage of the total sum owing by customers as per ledger. In some cases the percentage may be as low as 1 per cent; in others it may be 5 per cent or more, and having determined the amount to be reserved an entry should be made on the debit side of the bad debts account, with the words " To reserve." This amount

should be shown as the last item in the account and will be included in the amount transferred to the debit side of the periodical profit and loss account. It will also be brought down as the opening entry on the credit side of the bad debts account to commence the next period, but instead of showing it as a separate item on the liabilities side of the balance sheet it should be deducted from the figure of sundry debtors as shown on the assets side. A more satisfactory method of providing for irrecoverable debts is to examine carefully all the items enumerated in the list of outstanding balances, and to make a list of all amounts which are bad or doubtful of collection. The total of this list would be the sum to be reserved, although, of course, special attention should always be given to large amounts which have been owing for an unduly long period.

If customers are allowed a discount in respect of the prompt settlement of their accounts, or for payment within a stipulated or a recognised period, a sum may be reserved at balancing time to cover the discounts on sundry debtors. This reserve is usually based on the total of the ledger balances outstanding as per ledger at the date of stocktaking, and the percentage taken should correspond, as near as possible, with the ratio which the total of the discounts actually allowed to customers during the accounting period bears to the total amount of cash received from them. The reserve should be shown as the last entry in the discounts account, and included in the charge against the trading, and should be deducted from the figure of sundry debtors when drafting the balance sheet.

In the matter of repairs and maintenance of plant and equipment, a reserve may be made even though repairs are not likely to be put in hand for some time. The amount on the debit side of the repairs and renewals account should not exceed the average for the past two or three years and the reserve should be treated as a liability when drawing up the final accounts. If the particular book-keeping system in operation does not guarantee that all invoices for materials and charges have been entered in the books, adequate reserves should be made to cover the liabilities which have been incurred, including all apportionments due to overlapping.

Branch Expenses

Query.—"We are endeavouring to make an equitable distribution of branch selling expenses as a part of the administrative overhead charges and wish to know if any expenses other than the salaries and travelling expenses of the salesmen should be included."—J.E.

Reply.—In addition to the salaries and expenses of direct salesmen, the expenses of a branch include the salaries of the manager and of the clerical staff, and the cost of general maintenance and upkeep of the premises. The total expenses should be compared with the estimates, and may be divided by the number of items to secure a per item charge.

German Technical Reports

Some Recent Publications

SOME of the latest technical reports from the Intelligence Committee in Germany are detailed below. Copies are obtainable from H. M. Stationery Office at the prices stated.

BIOS 779. *Hereaus Vacuumschmelze A.G., Hanau A.M. and at Sterbfritz*: Production of seamless metallic pyrometer sheaths and electric resistance alloys (1s. 6d.).

BIOS 781. Synthetic-resin moulding plants and processes (4s. 6d.).

BIOS 811. *Dr. Alexander Wacker, Gesellschaft für Electrochemische Industrie, Burghausen*: Tetrachlorethane, vinyl chloride and polyvinyl chloride (2s. 6d.).

BIOS 815. *I.G. Farben A.G., Leverkusen*: Manufacture of hydrazine hydrate (6d.).

BIOS 817. *Krupp Treibstoffwerke, Wanne-Eickel*: Krupp-Lurgi low temperature carbonisation plant (1s.).

BIOS 834. *Kohlenwertstoff Verbaende A.G. Bochum*: Benzole and tar products distribution (1s.).

BIOS 886. Manufacture of hydrogen peroxide (2s.).

FIAT 715. *I.G. Farben, Th. Goldschmidt A.G., Permutit A.G., and Chemische Werke Albert*: Ion exchange, coating and plywood resins (5s.).

FIAT 723. Carbon bisulphide manufacture (4s. 6d.).

FIAT 767. Research on zinc base bearings (1s. 6d.).

FIAT 788. Aluminium hydroxy chloride production at Ludwigshafen by electrochemical and chemical methods (1s.).

FIAT 790. Production of sodium sulphide from sodium amalgam (1s.).

FIAT 799. Krupp-Renn and other processes for utilising low-grade iron ores (2s. 6d.).

Manufacture of Wofatit

Base-Exchange Resins—Uses and Properties

BIOS Report No. 621, prepared by Dr. N. E. Topp, D.S.I.R., on behalf of BIOS Team 1901, provides fairly detailed information on the manufacture and uses of resins having ion-exchange properties. These materials were formerly made at I.G. Wolfen, but manufacture is now being instituted at I.G. Leverkusen. Six different resins are marketed under the trade name "Wofatit," five of them being cation exchangers, types P, D, K, KS, and C, and the sixth (type M) being an anion exchanger.

Both Wofatit P and D are prepared from phenol, formaldehyde, and sodium sulphite, the resultant polymer being treated with sulphuric acid to promote further cross-linking, to eliminate any free alkali and at the same time to sulphonate the resin. Wofatit C is manufactured from 1.3.5 resorcylic acid (with or without admixture of phenol or resorcinol) and formalin, caustic soda being used as the condensing agent. The raw materials for Wofatit KS are benzaldehyde 2.4 disulphonic acid, phenol, resorcinol and formalin, which are condensed under acidic conditions, whereas for Wofatit K the same components are reacted in alkaline solution. Wofatit M, as an anion-exchange material is made from basic materials, *m*-phenylene diamine, polyethylene diamine and formaldehyde being condensed using hydrochloric acid as a reaction promoter. Full details of quantities, temperature, times, etc., are included in the text, which also details a list of the plant used in the manufacturing processes.

The principal use is for water-softening, type K or KS having been designed for use where large capacities at moderate temperatures (50° to 70° C.) are desired. For high temperatures (about 100° C.) type P is recommended, but the capacity is halved. Type C is a buffer filter, but can also be used to remove bicarbonate hardness. Applications mentioned in the report include feedwater for high pressure boilers, viscose manufacture, textile bleaching, dyeing, and brewing.

Ammonia and copper, which accumulate in the water used to regenerate cellulose from cuprammonium/cellulose solution can be removed by the use of Wofatit D. The difficulties due to the swelling of resin originally used for this purpose were overcome by altering the chemical constitution and, although the life was improved, capacity was reduced.

Properties

The following table published by Wesley (*Chem. Zeit.*, 1943, *67*, 338) and quoted in the report, gives details of the properties of the resins under working conditions:

Resin type	*Swollen weight of one litre (grams)*	*Particle size (m.m.)*	*Useful capacity kg. of CaO per 100 litres*	*Residual Hardness °G*	*Filter rate m³ water m³ resin per hour*	*Max. operating temp. °C.*	*P (e) value*
A	750-850	0.5-2.5	0.8-1.0 (a) 0.7-0.9	0.04-0.1	10-17	30	0
P	800-850	0.3-2.0	0.7-0.9 (a) 0.6-0.8	0.03-0.08	10-20 (b) 20-30 (c)	95 75	0 0.3-0.4
K	850-900	0.3-1.5	1.8-2.0 (a) 1.0-1.2	0.02-0.05	15-25	50	0
KS	850-900	0.3-1.5	1.6-1.8 (a) 1.0-1.2	0.02-0.05	15-25	70 50	0 0.3-0.4
M	800-850	0.3-2.0	1.0-1.3 (d)	SO_4'' nil Cl' 2-8 mg/1	5-10	95	
M			2.0-2.3 (d)				
C			1.2-2.2				

(*a*) as a hydrogen exchanger
(*b*) cold water.
(*c*) for hot water.
(*d*) figures quoted by Dr. Griessbach (I.G., Wolfen).

(*e*) The "P" value is a measure of the alkalinity and carbonate content of a water and is defined by the number of ccs. normal hydrochloric acid required to make one litre of the water neutral to phenolphthalein.

Both Wofatit KS and M can be used for sugar purification. Feedwaters for the emulsion polymerisation of vinyl chloride are reduced in hardness from 30° (German) to 0.03/0.06° by the use of Wofatit KS and M.

Other applications mentioned relate to the preparation of cobalt and nickel and recovery of silver from photographic residues, while the purification of gelatin and the recovery of phenol and acetic acid from various effluents are mentioned as possible fields of use.

Wofatit D is regenerated by sulphuric acid, types P, K, and KS being regenerated by a 7 per cent to 10 per cent solution of sodium chloride or hydrochloric acid, depending upon whether the resins have been used in the sodium or hydrogen cycle. Caustic soda or sodium bicarbonate is used for the regeneration of type M.

Lactic Acid from Sulphite Waste

Possible Solution of Pollution Problem

THE disposal of sulphite waste liquor is a serious problem that confronts the paper industry. At the present time most of this waste is discharged into rivers, lakes, or other bodies of water and results in a serious pollution that is objectionable to health and conservancy bodies. An industrial fellowship was established at the University of Wisconsin, U.S.A., by the Rhinelander Paper Company for a study of the fermentation of sulphite waste liquor to useful chemicals, the results of the work to be made available for the public interest or welfare.

Of the chemicals normally produced by fermentation, the production of lactic acid has not been previously attempted on sulphite waste liquor. It was found that the fermentation of the wood sugars was readily possible after suitable treatment of the liquor. Efforts were then directed toward problems dealing with the process as a whole. At the present time sufficient information is available from laboratory investigations to permit preliminary evaluation of the process and further expansion if necessary.

The laboratory results may be summarised as follows: The acid liquor from the blow-pits was best prepared for fermentation by steam stripping to remove sulphur dioxide and subsequent neutralisation to a slightly alkaline condition with slaked lime. After filtration to remove the sulphite precipitate and adjustment to the desired acidity by the addition of carbon dioxide the liquor was ready for fermentation. An inoculum was prepared of a lactic acid-producing organism, *Lacto- bacillus pentosus* 124-2, on a rich medium. The inoculum medium was preferably composed of malt sprouts and molasses although other preparations were known to serve equally as well. The fermentation required 40 to 48 hours at 30° C. for completion. During this period the lactic acid formed was neutralised by addition of calcium carbonate or slaked lime. Usually 1.8 per cent lactic acid was formed during fermentation.

The recovery of lactic acid was perhaps of greater difficulty than the fermentation itself. Recovery was best accomplished by first concentrating the fermented liquor from 12.5 per cent solids and 1.8 per cent lactic acid to about 40 per cent solids and 6 per cent lactic acid. Several solvents were selected which would extract the acids from the waste liquor and would not extract large amounts of impurity. Extractions were made successfully at 90° C. since at this temperature the high viscosity of the concentrate at room temperature may be avoided. The acids were then washed out of the solvent with water and this final aqueous solution was concentrated. The acetic acid which was naturally present in the liquor was removed by distillation. The purity of the crude concentrate varied with the solvent employed; with amyl alcohols the lactic acid was of 90 per cent strength, 8 per cent non-volatile impurity, and 2 per cent water. Methods for separating the lactic acid from the non-volatile impurity are under investigation.

Assuming 2,000 gallons of waste liquor per ton of pulp and 95 per cent recovery by the extractions, 285 lb. of lactic acid and 75 lb. of acetic acid may be obtained per ton. The yields varied with the wood species and the cooking procedure. However, the tremendous potental capacity of a single sulphite pulp mill would far exceed the present demands for the product; 9,000,000 lb. of lactic acid annually from a mill producing 100 tons of pulp daily in a 300-day year. The cost of raw materials and steam was computed on the laboratory data at 3.4 cents per lb. of acid recovered. If the lignin were useable as fuel, the cost might be reduced to 2.5 cents and the process would give a complete utilisation of sulphite waste liquor. It should be pointed out that no estimate is available for initial cost of a plant.

French official statistics show that France's October exports of chemicals to foreign countries were valued at 744,885,000 francs, as compared with 844,887,000 francs in September. Exports to French colonies rose in value from 285,126,000 francs to 307,330,000 francs,

Coal Research

Mr. R. W. Foot Stresses its Value

THE importance of research to the industries represented was emphasised by Mr. R. W. Foot in his presidential address at a luncheon given by the British Coal Utilisation Research Association in London recently.

"In my report to the council on the future work of C.U.R.A.," said Mr. Foot, "I expressed the opinion that in my view the ultimate success of this research association will be measured by the extent to which its discoveries, to use a general term, will in fact have been taken up and profitably used by the factories and homes of this country. I believe that this is the cardinal point to which any research association should direct its aims."

Mr. Foot was taking what he described as his last opportunity to address the Association as president before the nationalisation of the coal industry on January 1, He was able to announce that the National Coal Board—whose chairman, Lord Hyndley, was present—had accepted the principle that, from January 1, the Board should "step into the shoes" of the Mining Association in its relations with C.U.R.A.

The president's address reviewed the accomplishments of C.U.R.A., which is only now in its ninth year, and its plans for the future.

Down-Jet Furnace

Among the discoveries resulting from the Association's research work to which he referred was that of the down-jet furnace which, he said, had now been brought to the stage where it could be tried out in various applications in industry. For example, at Leatherhead they had a small furnace and boiler which together were not larger than an ordinary filing cabinet and which could produce 200 lb. of steam an hour at a pressure of 200 lb. per sq. in. Combustion was absolutely smokeless and the furnace could be started automatically from cold and give steam within a few minutes. The whole unit weighed about 6 cwt. and was self-contained; it could, if required, be mounted on a trolley and transported from place to place. The furnace would run for eight hours without any attention other than the requirements of the fuel hopper and was immediately responsive to varying steam demands.

So far as Mr. Foot was aware, this was the first unit which had ever been designed to use solid fuel and give all such advantages. Other prototype furnaces, he said, were being designed for use in the steel industry, in the refractories industry and for mould drying. Its application for use with gas turbines was also under consideration Up to the present, no satisfactory method of firing a gas turbine with gases from solid fuel had been developed, and the Association had every hope that the down-jet furnace would prove suitable.

Referring to the Research Laboratories as the "basis of all their work," Mr. Foot mentioned investigation at present in hand of chemical products of coal, where, he said, they were pursuing one or two lines of thought which might develop into matters of interest to the chemical industry.

Oil and Colour Chemists' Association

Lecture on Rheological Phenomena

THE third meeting of the 1946-47 Session of the Bristol Section of the Oil and Colour Chemists' Association was held at the Royal Hotel, Bristol, recently, when Dr. W. J. Dunning, M.B.E., gave a paper entitled "The Rheology of Solid, Liquid Dispersions."

The lecturer introduced his subject by citing honey, clay, and rubber as every-day examples of rheological phenomena. He pointed out the word "rheology" was of American origin and meant the science of deformation and flow. The difference between false-body and thixotropy was explained by the ability of the former to regain its original viscosity more rapidly than the latter after shearing stress had been removed. Thixotropic systems were characterised by a lattice structure and it was considered that this was maintained by Van der Waals' forces. The mathematical conception of flow phenomena had been studied by Einstein.

Experimental work carried out by the lecturer had been based on the use, as the continuous phase, of chlorinated diphenyl with a viscosity of 108-109 poises and which is a Newtonian fluid, and natural and synthetic rubber lattices as the disperse phases. Work on systems on which the continuous phase was considerably less viscous had not been carried out because it had not been possible to find a Newtonian fluid of low viscosity with a low modulus of elasticity.

The lecturer said that evidence had been secured that grinding of a pigment/oil system did reduce the particle size of the suspended solid and explained his experimental methods on a special type of knurled two roll mill. Experiments were described in which the sedimentation value of a pigment was reduced by adding small amounts of lecithin. The methods adopted during the experimental work were ingenious. The lecturer claimed that the determination of value was a measure of efficacy of any specific grinding method.

PARLIAMENTARY TOPICS

IN the House of Commons last week, several questions of interest to the chemical industry were put down. They ranged from housing of German scientists to glue imports.

Housing of German Scientists. — The acquisition by the Ministry of Works, for the use of German scientists, of Spedan Towers, a "large house with two acres of land" in Hampstead, London, was questioned by Mr. A. Lewis, who asked if the Minister would consider using this property for rehousing "bombed-out" people and placing the German scientists in Army Nissen huts.

Mr. Tomlinson explained that Spedan Towers had been requisitioned when vacant in 1940 by the War Department, but was now surplus to that Department's requirements. The Ministry of Health did not require it for housing as it could not be readily converted into flats; and it had been taken over by the Ministry of Works to house German scientists.

Dismantling of German Plants. — Sixty plants, including two concerned with metallurgy and three with chemicals, are at present scheduled to be dismantled in the British zone of Germany, stated the Chancellor of the Duchy of Lancaster, replying to Mr. F. Willey.

Linseed Oil from Argentina.—Reference was made to the agreement with the Argentine Government for the shipment of oils in 1947 when Colonel J. R. H. Hutchison asked the Minister of Food to what industries and in what proportions the 100,000 tons of linseed oil purchased would be allocated. Dr. Summerskill replied that it was too early to say how it would be allocated.

Brigadier Maclean sought assurance that a fair share would be given to the linoleum industry which, he said, was in "very bad state" owing to inadequate supplies. Dr. Summerskill, explaining that allocations were made by a committee representing all departments, was sure every industry would be taken into consideration.

Production of Groundnuts.—The scheme for large-scale production of groundnuts in East Africa was referred to by Mr. Turton in a question to the Secretary of State for the Colonies, advocating full publicity in the West African colonies to the Government announcement that it had complete confidence in the United Africa Company for the initiation of the scheme, based on the company's experience in East Africa.

Asked by Mr. Oliver Stanley when and in what form he intended to give the House full details of these plans, Mr. Creche Jones referred the question to the Ministry of Food which, he said, would take responsibility, though there would be fullest consultation with the Colonial Governments and the Colonial Office.

Palestine Potash. — Major Legge-Bourke asked the Secretary of State for the Colonies what steps were being taken to avoid the necessity of the Palestine Potash Company stopping production and what stocks were at present available.

Mr. Creche Jones replied that the Palestine railway resumed a full-time freight service the previous day and it was expected that the transport of potash to Haifa would return to normal within a few days. The stock of potash accumulated owing to the interruption of the railway freight service amounted to 20,000 tons.

Penicillin Lozenges. — The Minister of Health was asked by Mr. J. Lewis to prohibit use of penicillin for the production of lozenges which, apart from civilian requirements, he said, were absorbing 250,000,000 units for Service Department requirements, "in view of the fact that a lozenge containing only 500 units of penicillin was useless for the treatment of throat infection."

"No, Sir." replied Mr. Key. "I am advised that lozenges of this strength are quite effective.

Glue Imports.—A statement of policy regarding importation of glue was given by the the Board of Trade at the request of Mr. Erroll.

Licences to import glue and gelatine were granted freely, said the Parliamentary Secretary. The quantities licensed for import during the past three months showed a marked increase on figures for the previous months. Actual arrivals in the United Kingdom, however, had not so far been large.

Asked by Mr. Erroll why he was insisting on exporting glue at low prices and encouraging the importation of glue at high prices, he undertook to look into the matter.

Cement and Ancillary Industries. — The report of the committee appointed last December by the Minister of Works to inquire into the financial structure of the cement and ancillary industries will be presented early in January, when consideration will be given to its publication, Mr. Tomlinson stated in reply to Mr. Piratin.

Research departments of two Canadian firms claim that the melting time of ore and scrap in open hearth steel production can be reduced to one-fifth of present requirements by the use of oxygen.

Personal Notes

MR. R. J. BAINES, until recently a member of the London staff of Newton Chambers & Co., Ltd., has joined the London office staff of Henry Balfour & Co., Ltd., as a technical representative.

DR. H. W. KEENAN, chief chemist to the British Anti-Fouling Composition & Paint Co., Ltd., who is well known as president of the Oil & Colour Chemists' Association, will become manager of the technical sales service of Beck, Koller & Co. (England), Ltd., on January 1.

DR. ROBERT R. WILLIAMS, director of research of the Research Corporation, New York, has been awarded the 1946 Perkin Medal of the American Section of the Society of Chemical Industry for his outstanding accomplishments in fundamental research on vitamin B_1.

MR. A. BRADBURY, who has been in charge of the chemicals sales department of the Staveley Coal & Iron Co., Ltd., since its formation, has been appointed to the newly-created post of assistant commercial manager, and Mr. A. Slater has been appointed manager of the chemicals sales department.

MR. A. E. SYLVESTER, governor of the Gas Light & Coke Company, is relinquishing his office as governor at the end of the year on medical advice following a recent operation. He will continue as a director. The director have elected MR. MICHAEL MILNE-WATSON, son of the late Sir David Milne-Watson, to be governor, and Mr. F. M. BIRKS as deputy governor in place of Mr Henry Woodall, whose retirement was recently announced.

Obituary

PROFESSOR PAUL LANGEVIN, whose death at the age of 74 occurred in Paris last week, rendered great services to science as a physicist. He entered the Ecole de Physique et de Chimie Industrielle at the age of 16 and after studying and working elsewhere took his D.Sc. in 1902. He succeeded Pierre Curie in the School of Physics and Chemistry, of which he became director in 1925.

Seaweed processing plants have been established in British Columbia. One firm is to manufacture mineral salt tablets for human use and cattle food conditioning, using two varieties of kelp; another is producing agar, and a third is interested in production of alginic acid for moulded products and as a textile material.

Home News Items

Seven more Welsh steel sheet mills will be opened early in the New Year—four at Neath and three at Llanelly. They include the sheet steel mills at the Melyn works, which have been idle since 1941, now taken over by the Neath Sheet Steel and Galvanising Company.

A change of address is announced by the British Tar Confederation and the Coal Tar Research Association, who will shortly be moving to Gas Industry House, 1, Grosvenor Place, London, S.W.1. (Tel. SLOane 6119). All communications should now be sent to the new address.

The Paint Marketing Council has issued a statement pointing out that Great Britain's recent purchase of Argentine oilseed products, including 100,000 tons of linseed oil spread over next year, is unlikely to bring about any increase in paint supplies in this country. The oil will be allocated to the linseed oil consuming industries, and the paint industry will receive its share as the leading consumer.

U.K. exports in November remained at the same volume as the previous month, but they went up in value by £1,200,000 to £92,100,000, which exceeded the July peak by £200,000. Smaller imports of food and drink reduced the figure for total imports by £3,100,000 to £124,300,000 compared with October, but still left it higher than in any earlier post-war month in terms of both value and volume.

The heavy chemical plant section of Cannon Iron Foundries, Ltd., is producing at a far greater rate than at any time in the company's history, according to a statement made by Mr. A. F. Oatley, chairman and joint managing director, speaking at the recent annual meeting. He said plans are in hand for further extensions in this section where market demand, especially export, is greatly in excess of present production capacity and is likely to remain so for a long period.

The Charles Brotherton Chemical Engineering Laboratory at Leeds University was officially opened on December 12 by Mr. George Brotherton-Ratcliffe, in the absence, through illness, of Mr. Charles Brotherton. The Vice-Chancellor, Mr. B. Mouat Jones, explained that the premises would be used temporarily until permits were granted for the building of the laboratory for which, in 1945, Mr. Brotherton had given £55,000. Even so, the University was now in a position to go ahead with the proper training of chemical engineers.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

FROME CHEMICAL CO., LTD. (M., 28/12/46.) November 22, charge to Westminster Bank, Ltd., securing all moneys due or to become due to the bank: charged on land and premises at Christchurch Street East, Frome, including fixtures. *Nil. October 19, 1946.

McCLURE YOUNG & CO., LTD., London, W., manufacturers of disinfectants. (M., 28/12/46.) November 21, £4500 (not ex.) Land Registry charge to Lloyds Bank, Ltd.; charged on 159 Bollo Bridge Road, Acton. *Nil. June 13, 1946.

Satisfaction

JOHN PRENTICE (LONDON), LTD., London, W.C., manufacturers of chemical products. (M.S., 28/12/46.) Satisfaction November 29 of debentures registered March 7, 1945, to the extent of £1,500.

The nominal capital of **Phensic International Products, Ltd.,** 68 Pall Mall, London, S.W.1, has been increased, beyond the registered capital of £100, by £2400, in £1 shares.

Chemical and Allied Stocks and Shares

ALTHOUGH business in stock markets has contracted owing to holiday influences, firmness has been maintained, helped by a better tendency in British Funds. Home rails strengthened, but the prior charge stocks remained below their "take-over" levels. Industrial shares claimed chief attention, with buying again centred mainly on shares in industries outside the Government's nationalisation programme. Yield considerations again attracted demand to iron and steels, and chemicals and kindred shares also remained in favour.

Imperial Chemical at 45s. 1½d. held virtually all their recent good advance, it being pointed out that, in comparison with the return on many other leading industrial shares, they still offer a not unattractive yield. Moreover, it is generally assumed that sooner or later the dividend, which has been limited to 8 per cent for some years, will be less conservative. B. Laporte were 103s. 6d., Lever & Unilever 52s. 6d., and Turner & Newall firmer at 88s. 6d. Fisons attracted more attention and moved up to 64s. 3d., while British Drug Houses at 61s. 3d. further improved on expected benefits from the abolition of E.P.T. and the probable scope for fresh expansion in export trade. Greeff-Chemicals 5s. ordinary showed firmness at 13s. 6d., and Borax Consolidated, on higher dividend hopes, have been well maintained at 48s. 3d. British Aluminium were steady at 45s. 9d., while in other directions, British Glues & Chemicals 4s. ordinary rose further to 17s. 9d. At 55s. British Match continued firm, W. J. Bush were again quoted at 90s. but remained tightly held with few shares available in the market. British Plaster Board showed firmness at 34s., with Associated Cement 68s. 9d.

Reflecting hopes that the upward trend in iron and steel output will be continued next year with benefits to earnings, iron and steel shares attracted rather more attention, prices showing moderate gains. United Steel were 26s. 9d., South Durham Steel 27s. 9d., and Dorman Long 28s. Whitehead Iron advanced further to 103s. 9d. In other directions, Babcock & Wilcox were good at 70s. 9d., John Summers rose to 36s. 6d., and Allied Ironfounders were 64s. Guest Keen have been prominent at 48s. 6d. Tube Investments touched £7⅛, and Stewarts & Lloyds were 56s. 6d.

Bradford Dyers at 26s. 3d.; Bleachers 14s. 6d., and Calico Printers 24s. 3d. have been steady, while in other directions, Courtaulds continued active around 54s. 3d., with British Celanese higher at 33s. German potash bonds became steadier after their recent fall.

Boots Drug were little changed at 63s 9d., Beechams deferred 28s., Sangers 34s 3d., Griffiths Hughes 62s. 7½d., and Timothy Whites 49s. 6d. Paint shares held the greater part of recent gains, although they were less active, Goodlass Wall being 22s. 10½d., and International Paint £7¼, with Pinchin Johnson 51s. 6d. Linoleum shares were also less firm on the latest news regarding linseed oil supplies, Nairn & Greenwich being 85s., and Barry & Staines 59s. 3d. De La Rue were £13¾, and British Industrial Plastics 2s. shares 8s. There was a better tendency in Triplex Safety Glass 10s. ordinary at 38s. 6d. The latter offer only a moderate yield on the basis of last year's reduced dividend, but there is a strong balance-sheet position, and it is generally assumed that in time dividends are likely to regain pre-war levels. Oil shares remained dull, Shell further easing to 9s., and Burmah Oil to 65s. Canadian Eagle Oil showed activity but failed to hold best levels.

Prices of British Chemical Products

THE approach of the end of the year has not witnessed any important changes in the London industrial chemicals market, although an upward revision of prices in some directions is considered more than a possibility. A strong demand has persisted in most sections and the supply position generally shows no sign of an immediate improvement. The past week has been dominated by the Christmas holiday and activity has been restricted accordingly.

MANCHESTER.—Holiday influences have had an unmistakable effect on trading conditions on the Manchester chemical market during the past week, not only in respect of new bookings, but also from the point of view of contract deliveries. The latter have been brought virtually to a standstill owing to the stoppages at textile mills and other consuming works, the majority of which are closed down for longer periods than usual for Christmas. A steady resumption is looked for as soon as the holidays are out of the way and also active fresh buying for home use as well as for shipment.

Price Changes

Rises: Glycerine, oxalic acid (Manchester), salicylic acid (Manchester), sulphuric acid.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton, £47 10s.; 80% pure, 1 ton, £49 10s.; commercial glacial, 1 ton, £59; delivered buyers' premises in returnable barrels: £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r. MANCHESTER: £16 to £16 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER: £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—MANCHESTER: £40 per ton d/d.

Ammonium Carbonate.—£42 per ton d/d in 5 cwt. casks. MANCHESTER: Powder, £43 d/d.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £19 10s. per ton. See also Salammoniac.

Ammonium Persulphate.—MANCHESTER: £5 per cwt. d/d.

Antimony Oxide.—£120 to £123 per ton.

Arsenic.—Per ton, 99/100%, £38 6s. 3d. to £41 6s. 3d., according to quality, ex-store.

Barium Carbonate.—Precip., 4-ton lots, £19 per ton d/d; 2-ton lots, £19 5s. per ton. bag packing, ex works.

Barium Chloride.—98/100% prime white crystals, 4-ton lots, £19 10s. per ton, bag packing, ex works.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £18 15s. per ton d/d; 2-ton lots, £19 10s. per ton.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax.—Per ton for ton lots, in free 1-cwt. bags, carriage paid: Commercial, granulated, £30; crystals, £31; powdered, £31 10s.; extra fine powder, £32 10s. B.P., crystals, £39; powdered, £39 10s.; extra fine, £40 10s. Borax glass, per ton in free 1-cwt. waterproof paper-lined bags, for home trade only, carriage paid: lump, £77; powdered, £78.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granulated, £52; crystals, £53; powdered, £54; extra fine powder, £56. B.P., crystals, £61; powder, £62; extra fine, £64.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£22 per ton, ex wharf. Granulated, £27 per ton.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5⅝d. per lb.

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Carbonate.—MANCHESTER: £8 15s. per cwt. d/d.

Copper Oxide.—Black, powdered, about 1s. 4½d. per lb.

Copper Sulphate.—£37 10s. per ton f.o.b., less 2%, in 2 cwt. bags.

Cream of Tartar.—100 per cent., per cwt., from £12 14s. 6d. for 10-cwt. lots to £14 1s. per cwt. lots, d/d. Less than 1 cwt., 2s. 5½d. to 2s. 7½d. per lb. d/d.

Formaldehyde.—£27 to £28 10s. per ton in casks, according to quantity, d/d. MANCHESTER: £28.

Formic Acid.—85%, £54 per ton for ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1260 s.g., £6 per cwt. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—11d. per lb. d/d, carboys extra and returnable.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d per lb., according to quantity.

Lactic Acid.—Pale tech., £60 per ton; dark tech., £53 per ton ex works; barrels returnable.

Lead Acetate.—White, 70s. to 75s. per cwt., according to quantity.

Lead Nitrate.—About £70 per ton d/d in casks. MANCHESTER: £70 to £72.

Lead, Red.—Basic prices per ton: Genuine dry red lead, £71; orange lead, £83. Ground in oil: Red, £92; orange, £104. Ready-mixed lead paint: Red, £99; orange, £111.

Lead, White.—Dry English, in 8-cwt. casks, £83 per ton. Ground in oil, English, in 5-cwt. casks, £102 per ton.

Litharge.—£68 10s. to £71 per ton, according to quantity.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £36 per ton.

Magnesium Chloride.—Solid (ex wharf), £27 10s. per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., for 2-cwt lots, 9s. 1d.; smaller quantities dearer.

Mercurous Chloride.—10s. 1d. to 10s. 7d. per lb., according to quantity

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 3s. per gal.; pyridinised 64° O.P. 100 gal., 3s. 1d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works

Oxalic Acid.—£100 to £105 per ton in ton lots packed in free 5-cwt. casks. MANCHESTER: £5 to £5 5s. per cwt.

Paraffin Wax.—Nominal.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £76 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate. — Crystals and granular, 7½d. per lb.; ground, 8¾d. per lb., for not less than 6 cwt.; 1-cwt. lots, ½d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £57 per ton for 5-ton lots, £57 10s. per ton for 1 to 5-ton lots, all ex store; hydrated, £51 per ton for 5-ton lots, £51 10s. for 1 to 5-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according tc quantity.

Potassium Permanganate.—B.P., 1s. 8½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8d. per lb.; technical, £7 14s. 3d. to £8 6s. 3d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Salicylic Acid.—MANCHESTER: 1s. 10d. to 2s. 2d. per lb. d/d.

Soda, Caustic. — Solid 76/77%; spot, £16 7s. 6d. per ton d/d.

Sodium Acetate.—£42 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 6½d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite. — Powder, 60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2 cwt. free bags

Sodium Chlorate.—£45 to £47 per ton.

Sodium Hyposulphite.—Pea crystals 19s. per cwt. (ton lots); commercial, 1-ton lots, £17 per ton carriage paid. Packing free.

Sodium Iodide.—B.P., for not less than 28 lb., 10s. 2d. per lb.

Sodium Metaphosphate (Calgon).—11d. per lb. d/d.

Sodium Metasilicate.—£16 10s. per ton, d/d U.K. in ton lots.

Sodium Nitrite.—£23 per ton.

Sodium Percarbonate.—12½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £25 per ton d/d for ton lots. Tri-sodium, £27 10s. per ton d/d for ton lots (crystalline).

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salt).—£5 5s. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. MANCHESTER: £4 12s. 6d. to £4 15s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot, £20 2s. 6d. per ton, d/d, in drums; crystals, 30/32%, £13 7s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £14 5s. to £16 10s., according to fineness.

Sulphuric Acid.—168° Tw., £6 2s. 8d. to £7 2s. 8d. per ton; 140° Tw., arsenic-free, £4 15s. per ton; 140° Tw., arsenious, £4 7s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—Per cwt., for 10 cwt. or more, £15 8s.; 5 to 10 cwt., £15 9s. 6d.; 2 to 5 cwt., £15 11s.; 1 to 2 cwt., £15 13s. Less than 1 cwt., 3s. 1d. to 3s. 3d. per lb. d/d, according to quantity.

Tin Oxide.—1 cwt. lots d/d £25 10s.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d; white seal, £58 10s.; green seal, £57 10s.; red seal, £56.

Zinc Sulphate.—Tech., £25 per ton, carriage paid.

Rubber Chemicals

Antimony Sulphide.—Golden, 1s. 8½d. to 2s. 7½d. per lb. Crimson, 2s. 7½d. to 3s. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 8s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£37 to £41 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£48 to £51 per ton, according to quantity

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 10 5/16d to 1s. 5¾d. per lb.; dark, 10¼d. to 1s. per lb.

Lithopone.—30%, £28 2s. 6d. per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Phosphate.—Imported material, 11% nitrogen, 48% phosphoric acid, per ton in 6-ton lots, d/d farmer's nearest station, in December £20 4s. 6d., rising by 2s. 6d. per ton per month to March, 1947.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, in December £9 18s. 6d., rising by 1s. 6d., per ton per month to March, 1947.

Calcium Cyanamide.—Nominal; supplies very scanty.

Concentrated Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. No. 1 grade, where available, £14 18s. 6d.

"Nitro Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £17 5s. per ton; granulated, over 98%, £16 per ton.

Coal Tar Products

Benzol.—Per gal. ex works: 90's, 2s. 6d.; pure, 2s. 8½d.; nitration grade, 2s. 10½d.

Carbolic Acid.—Crystals, 11½d. per lb. Crude, 60's, 4s. 3d. Manchester: Crystals, 9½d. to 11½d. per lb., d/d; crude, 4s. 3d., naked, at works.

Creosote.—Home trade, 5¾d. to 8d. per gal., according to quality, f.o.r. maker's works. Manchester, 6½d. to 9¾d. per gal.

Cresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. Manchester: Pale, 99/100%, 4s. 4d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £7 2s. 6d. to £10 per ton, according to m.p.; hot-pressed, £11 10s. to £12 10s. per ton, in bulk ex works; purified crystals, £25 15s. to £28 15s. per ton. Controlled prices.

Pitch.—Medium, soft, home trade, 75s. per ton f.o.r. suppliers' works; export trade, 120s. per ton f.o.b. suppliers' port. Manchester: 77s. 6d. f.o.r.

Pyridine.—90/140°, 18s. per gal.; 90/160°, 14s. Manchester: 14s. 6d. to 18s. 6d. per gal.

Toluol.—Pure, 3s. 2½d. per gal.; 90's, 2s. 4d. per gal. Manchester: Pure, 3s. 2½d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 8½d. to 3s. 6d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £15 per ton; grey, £22.

Methyl Acetone.—40/50%, £56 to £60 per ton.

Wood Creosote.—Unrefined, from 3s. 6d. per gal., according to boiling range.

Wood Naphtha.—Miscible, 4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. to 6s. 6d. per gal.

Wood Tar.—£6 to £10 per ton.

Intermediates and Dyes (Prices Nominal

***m*-Cresol** 98/100%.—Nominal.

***o*-Cresol** 30/31° C.—Nominal.

***p*-Cresol** 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb; 66/68° C., 1s.

***p*-Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

***o*-Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

***p*-Toluidine.**—2s. 2d. per lb., in casks.

***m*-Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

London.—December 23. For the period ending December 28 (February 1, 1947, for refined oils), per ton, naked, ex mill, works or refinery, and subject to additional charges according to package; Linseed Oil, crude, £135. Rapeseed Oil, crude. £91. Cottonseed Oil, crude, £80; washed, £84. Coconut Oil, crude, £80; refined deodorised, £84; refined hardened deodorised, £88. Palm Kernel Oil, crude, £79; refined deodorised, £84; refined hardened deodorised, £88. Palm Oil (per ton c.i.f.), in returnable casks, £58 10s.; in drums on loan, £58; in bulk, £57. Groundnut Oil, crude, £56 10s.; refined deodorised, £86; refined hardened deodorised, £90. Whale Oil, refined hardened, 42 deg., £89; refined hardened, 46/48 deg., £90. Acid Oils. Groundnut, £55; soya, £53; coconut and palm-kernel, £58 10s. Rosin: Wood, 32s. to 45s.; gum, 44s. to 54s. per cwt., ex store, according to grade. Turpentine, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification

Applications for Patents

Azomethine dyes.—General Aniline & Film Corporation. 34568.

Merocyanines.—General Aniline & Film Corporation. 34938.

Dyestuffs.—General Aniline & Film Corporation. 34939.

Heating mixtures.—P. A. H. Goldsmith, and Heaters, Ltd. 34672.

Preparation of silica.—D. E. B. Greensmith, C. Shaw, and W. E. Smith. 34581.

Phthalocyanine derivatives.—N. H. Haddock, C. Wood, and I.C.I., Ltd. 34640.

Magnesium hydroxide.—D. V. N. Hardy, and D. G. Grant. 34791.

Cracking hydrocarbons.—Hercules Powder Co. 34324-5.

Spirit rectifying apparatus.—W. W. Hutcheson, and W. C. Mason. 34921.

Gasification of carbonaceous material.—C. P. Jenkyns. 34257.

Nickel-chromium steels.—W. Jessop & Sons, Ltd., D. A. Oliver, and G. T. Harris. 34621.

Saponification products.—Jiri Schicht A/S. 34464.

Alky sulphonates.—Jiri Schicht, A/S. 34465.

Sterols.—Jiri Schicht, A/S. 34467.

Fat stabilisators.—Jiri Schicht, A/S. 34468.

Fatty acids.—Jiri Schicht, A/S. 34469.

Enriching chrome ores.—R. Job. 34720.

Rubber calendering device.—F. Landau, J. G. Norberg, and Allmanna Svenska Elektriska A/B. 34364.

Production of wire, etc., from powdered material.—Mallory Metallurgical Products, Ltd., and C. C. Hyde. 34902.

Phenanthridine derivatives.—May & Baker, Ltd., and H. J. Barber. 34582.

Corrosion inhibitors.—Merck & Co., Inc. 34372.

Unsaturated alcohols.—N.V. de Bataafsche Petroleum Maatschappij. 34296.

Anthracene derivatives.—Neville Co. 34677.

Laminated materials.—Plaswood Corporation. 34432.

Abrasive coated material.—W. F. Procter, G. W. Webb, and K. B. Pearce. 34810.

Polarographic analysis.—J. E. B. Randles, and L. Airey. 34891.

Compounding of rubber.—Redfern's Rubber Works, Ltd., and F. E. Brown. 34543.

Fibrous products.—G. Slayter. 34433.

Anthraquinone dyestuffs.—F. H Slinger, W. W. Tatum, and I.C.I., Ltd. 34641.

Organo-silicon compounds.—F. J. Sowa. 34600-1.

Condensation polymers.—Wingfoot Corporation. 34565.

Carboxylic acids.—Winthrop Chemical Co., Inc. 34678.

Vapour burners.—G. W. Zimbelman. 34932.

Complete Specifications Open to Public Inspection

Evaporator plants.—Gotaverken A, B. May 19, 1945. 20618/45.

Alkamine esters of 1-cyclohexylpyrrole-3, 4-dicarboxylic acids.—American Cyanamid Co. July 31, 1943. 12006/44.

Production of polymerised halogen substituted ethylene compositions.—American Cyanamid Co. May 26, 1945. 15326-7/46.

Process for the fermentative treatment of vegetable materials, in particular of cereals and their waste products. Bouckova, O., and Kriz, A. April 15, 1942. 32175/46.

Automatic control of the rate of ion-exchange in the purification of water or the treatment of salt solutions.—Carbonisation et Charbons Acties. Jan. 10, 1945. 31473/46.

Manufacture of disazo dyestuffs.—Ciba, Ltd. May 25, 1945. 15223-4/46.

Manufacture of organo-siloxanes.—Corning Glass Works. March 30, 1943. 8281/44.

Polymerisation of unsaturated compounds.—E.I. Du Pont de Nemours & Co. May 22, 1945. 15485/46.

Polymerisation and interpolmerisation of ethylene.—E.I. Du Pont de Nemours & Co. May 22, 1945. 15486/46.

Abrasive compositions.—Fish-Schurman Corporation. May 26, 1943. 8843/44.

Vapour generators.—Foster Wheeler. Ltd. May 24, 1945. 15514/46.

Interpolymer of esters of α-haloacrylic acid polychorostyrene.—General Aniline & Film Corporation. May 24, 1945. 11562/46.

Vinyl-synthetic rubber compositions and synthetic rubber.—B. F. Goodrich Co. Aug. 12, 1944. 32205/46.

Pest control compositions.—I.C.I., Ltd. June 2, 1943. 14911/44.

Process for washing or chemically cleaning porous spongy materials made of regenerated cellulose or cellulose derivatives—Kooperativa Forbundet Forening U.P.A. April 27, 1945. 12876/46.

Method for the continuous production of soap.—L'Oreal Soc. Anon. Aug. 27, 1943. 21228/46.

Styrene fractionation.—Lummus Co. May 5, 1942. 7421/43.

Refractory metal composition.—Mallory Metallurgical Products, Ltd. May 23, 1945. 10180/46.

Chemical manufacture.—Mathieson Alkali Works. May 24, 1945. 6866/46.

Process for carrying out catalytic reactions in the gas phase.—N.V. de Bataafsche

Petroleum Maatschappij. July 27, 1944. 31639/46.

Hydrocarbon treatment.—N.V. Internationale Hydrogeneeringsoctrooien Maatschappij. May 26, 1945. 12402/46.

Complete Specifications Accepted

Hot rolling of metals and alloys.—N. E. Allott. Sept. 1, 1944. 582,293.

Concentration of non-sulphide iron ores. —American Cyanamid Co. April 5, 1943. 582,450.

Production of polystyrene.—A. Boake Roberts & Co., Ltd., and B. T. D. Sully. July 19, 1943. 582,327.

Creep resistant alloys.—British Driver-Harris Co., Ltd. (Driver-Harris Co.) June 24, 1943. 582,417.

Glass compositions.—British Thomson-Houston Co., Ltd., and J. E. Stanworth. June 23, 1944. 582,353.

Solidifying normally liquid hydrocarbons. —D. M. Clark. (Safety Fuel, Inc.) Feb. 14, 1944. 582,337.

Manufacture of articles made from cellulose acetate.—Courtaulds, Ltd., C. Diamond, and A. Hill. Aug. 29, 1944. 582,284.

Production of solid and semi-solid polymers and interpolymers of ethylene.—I.C.I., Ltd. Jan. 19, 1942. 582,334.

Production of polymeric materials.—I.C.I., Ltd. May 24, 1943. 582,348.

Passivation of zinc and cadmium surfaces including electro-galvanised, galvanised zinc sprayed, zinc plated and cadmium plated surfaces.—International Corrodeless, Ltd., and R. W. Taylor. Oct. 3, 1944. 582,386.

Production of anhydrous magnesium chloride.—Magnesium Elektron, Ltd., and J. A. Dukes. Jan. 11, 1944. 582,332-3.

Production of anhydrous magnesium chloride. Magnesium Elektron, Ltd., S. J. Fletcher, and A. L. Hock. Sept. 7, 1944. 582,357.

Vulcanising of synthetic rubber.—Monsanto Chemical Co. Sept. 13, 1943. 582,305.

Manufacture of synthetic resins.—P. H. Rhodes. March 17, 1944. 582,448.

Dehydrogenation of hydrocarbons.—Shell Development Co. March 16, 1942. 582,416.

Catalytic processes.—Standard Oil Development Co. July 24, 1941. 582,414.

Hydration of olefins.—Standard Oil Development Co. Aug. 6, 1942. 582,418.

Electrowinning of manganese.—A. H. Stevens. (Electro Manganese Corporation.) April 11, 1944. 682,451.

Apparatus for converting molten glass and the like to fine fibres.—A. P. Thurston. (Owens-Corning Fiberglas Corporation.) June 1, 1944. 582,472.

Utilising waste heat from internal-combustion engines.—W. W. Triggs. (Maxim Silencer Co.) June 15, 1945. 582,399.

Dithiofuroates.—Wingfoot Corporation. Jan. 5, 1944. 582,316.